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Taxonomic studies on seven species of the genus *Opopaea* (Araneae, Oonopidae) from Kenya

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Abstract

Seven species of the genus *Opopaea* Simon, 1892 from Kenya are recognized, including five new species: *O. berlandi* (Simon & Fage, 1922), *O. kulczynskii* (Berland, 1914), *O. makadara* Tong & Li, **sp. nov.** (♀♂), *O. ngangao* Tong & Li, **sp. nov.** (♀♂), *O. ngulia* Tong & Li, **sp. nov.** (♂), *O. sheldrick* Tong & Li, **sp. nov.** (♀♂), and *O. wundanyi* Tong & Li, **sp. nov.** (♀♂). Morphological descriptions and illustrations of all the species are given. All types are preserved in the National Museums of Kenya in Nairobi, Kenya (NMK).

Keywords

Africa, goblin spider, morphology, new species, taxonomy

Introduction

Opopaea Simon, 1892 is one of the most species rich genera of the spider family Oonopidae Simon, 1890, distributed in tropical and subtropical regions. A total of 182 valid extant species are currently known (WSC 2019).

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Although *Opopaea* is one of the most diverse and widely distributed oonopid genera, we know surprisingly little about the overall diversity of this group in Africa. Saaristo and Marusik (2008) recognized 20 species of *Opopaea* from Africa and adjacent islands, five of which were new to science. Andriamalala and Hormiga (2013) recorded 27 species from Madagascar, 26 species of which were newly described. Only five species are known for Kenya, namely, *O. berlandi* (Simon & Fage, 1922), *O. foulpointe* Andriamalala & Hormiga, 2013, *O. hoplites* (Berland, 1914), *O. kulczynskii* (Berland, 1914) and *O. simoni* (Berland, 1914). Here we recognize seven species of the genus *Opopaea* from Kenya, five of which are new to science. All species which are reported in this paper are described and figured.

Materials and methods

The specimens were examined using a Leica M205C stereomicroscope. Details were studied under an Olympus BX53 compound microscope. Photos were taken with a Canon EOS 750D zoom digital camera (18 megapixels) mounted on an Olympus BX53 compound microscope. Scanning electron microscope images (SEM) were taken under high vacuum with a Hitachi TM3030 after critical point drying and gold-palladium coating. All measurements were taken using an Olympus BX53 compound microscope and are in millimeters.

The materials are preserved in the National Museums of Kenya in Nairobi, Kenya (**NMK**).

Abbreviations used in the text:

AL	abdomen length;
ALE	anterior lateral eyes;
ALE-ALE	distance between ALE and ALE;
ALE-PLE	distance between ALE and PLE;
AW	abdomen width;
CBL	cymbiobulbus length;
CBW	cymbiobulbus width;
CL	carapace length;
CW	carapace width;
EGW	eye group width;
FI	femur insertion on patella;
FML	femur length;
PLE	posterior lateral eyes;
PME	posterior median eyes;
PME-PME	distance between PME and PME;
PLE-PME	distance between PLE and PME;
PTL	patella length;
TL	total length.

Used in the figures:

apo apodeme;
asr anterior scutal ridge;
boc booklung covers;
dte dorsolateral, triangular extensions;
ga globular appendix;
lpr linguiform projection;
nlp nail-like process;
pd postgynal depression;
pls paddle-like sclerite;
rds ring-shaped dark spot;
sds stick-shaped dark spot;
sr scutal ridges.

Taxonomy

Family Oonopidae Simon, 1890
Genus *Opopaea* Simon, 1892

***Opopaea berlandi* (Simon & Fage, 1922)**
Figs 1–3, 21A–C, 23A, B, 25A, H

Gamasomorpha berlandi Simon & Fage, 1922: 535, figs 4.4–6 (syntypes 1 ♀ and 3 ♂ from Kenya, Coast Province, "Grotte A de Shimoni, provo de Seyidié" [Shimoni caves, near to 4°38'S, 39°23'W], 9.XI.1911, in Muséum national d'Histoire naturelle, not examined).
Opopaea berlandi: Brignoli 1975: 230; Saaristo and Marusik 2008: 20, figs 8–10 (♂).

Material examined. 1 ♂ (NMK Ar-25102), 2 ♀ (NMK Ar-25103-25104), Kenya, Kilifi County, Watamu Town, Jilore Sites, 03°16.239'S, 39°55.611'E, 43 m, 21.VII.2016, Kioko G.M., Yao Z. & Zhao Q. 2 ♂ (NMK Ar-25105-25106), 3 ♀ (NMK Ar-25107-25108-25109), Kwale County, Ukunda Town, Shimba Hills National Reserve, Sheldrick falls, 04°17.121'S, 39°25.886'E, 127 m, 18.VII.2016, Kioko G.M., Yao Z. & Zhao Q.

Diagnosis. Males can be recognized by the tubercle-shaped ridges on posterior part of sternum (arrow in Fig. 1F), the very small booklung covers (Fig. 1H), and the truncate tip of cymbiobulbus (Fig. 2E); females are recognized by the dark, linguiform projection on the epigastric scutal ridge (lpr in Fig. 23A).

Description. Male. Yellow. Habitus as in Fig. 1A, C, E. Body length 1.20. Carapace (Fig. 1B): wide oval in dorsal view; sides with longitudinal streaks; dorsal area finely reticulate, with some setae at lateral edges, several setae on the posterior margin of dorsal surface with very large hair base. Eyes: ALE largest, PLE smallest; posterior eye row recurved viewed from above, procurved from front; ALE separated by less than their radius, ALE-PLE separated by less than ALE radius, PME touching throughout most of their length, PLE-PME separated by less than PME radius. Clypeus height about 0.9 times ALE diameter (Fig. 1G). Sternum as long as wide, fused to carapace; surface finely reticulate, with medium sized pits, with a pair of tubercle-shaped ridges on posterior part (arrows in Fig. 1F); radial furrows present only between coxae I-II,

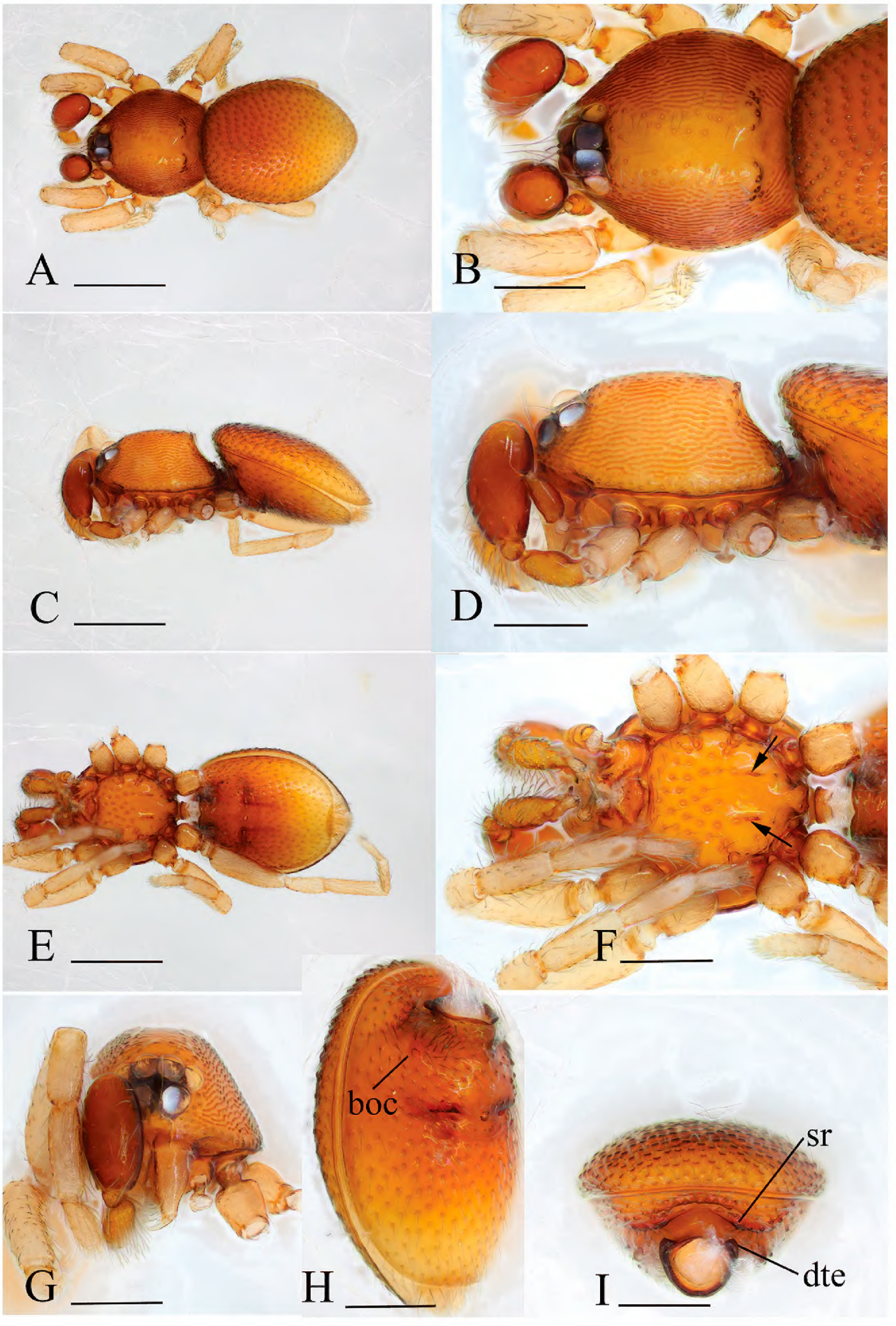

Figure 1. *Opopaea berlandi*, male. **A, C, E** habitus, dorsal, lateral and ventral views **B, D, F, G** prosoma, dorsal, lateral, ventral and anterior views **H, I** abdomen, lateral and anterior views. Abbreviations: boc = booklung covers; dte = dorsolateral, triangular extensions; sr = scutal ridge. Scale bars: 0.4 mm (**A, C, E**); 0.2 mm (**B, D, F–I**).

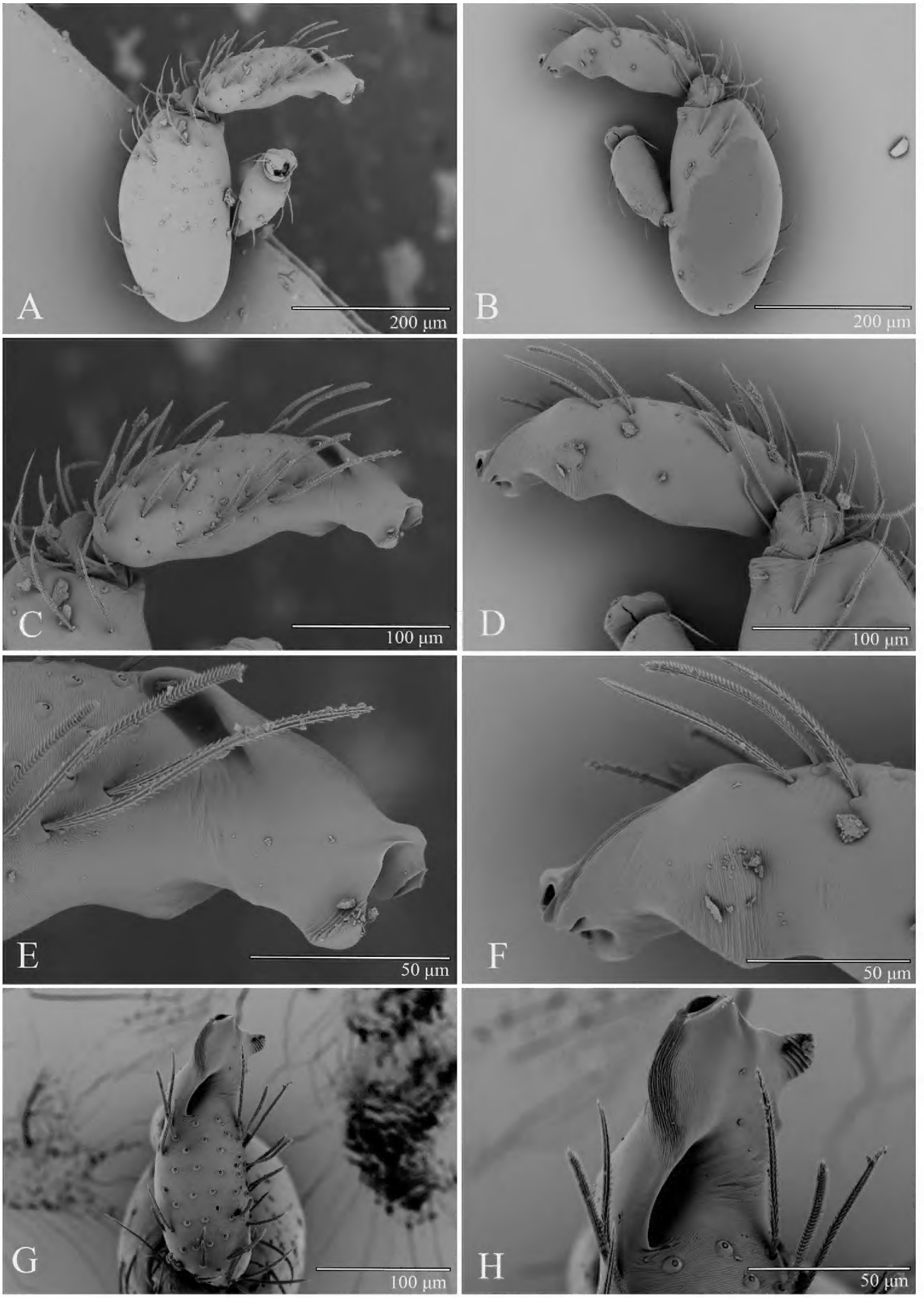

Figure 2. *Opopaea berlandi*, male left palp, SEM. **A, B** prolateral and retrolateral views **C, D, G** cymbiobulbus, prolateral, retrolateral and dorsal views **E, F, H** distal part of cymbiobulbus, prolateral, retrolateral and dorsal views.

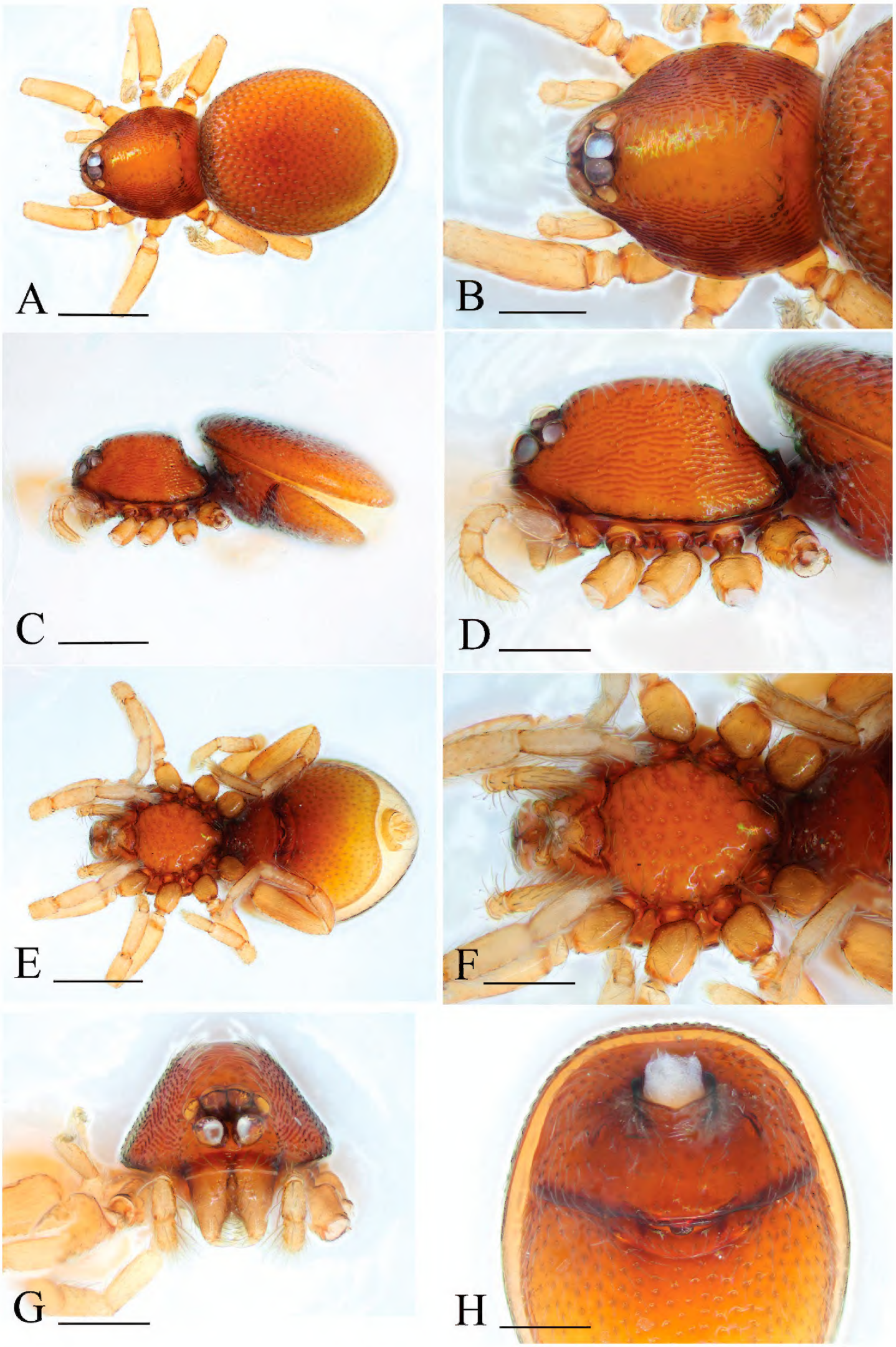

Figure 3. *Opopaea berlandi*, female. **A, C, E** habitus, dorsal, lateral and ventral views **B, D, F, G** prosoma, dorsal, lateral, ventral and anterior views **H** abdomen, ventral view. Scale bars: 0.4 mm (**A, C, E**); 0.2 mm (**B, D, F–H**).

II-III. Anterior end of endites with a small, sharply pointed projection. Legs light yellow. Abdomen: booklung covers very small, ovoid, without setae. Pedicel tube short, ribbed, with small, dorsolateral, triangular extensions, scuto-pedicel region as high as diameter of pedicel, with arched scutal ridges and curved anterior scutal ridge (Fig. 1I). Palp (Figs 2, 21A–C): reddish brown; femur slightly shorter than half the length of patella and inserted at the patella submedially; patella very large; cymbiobulbus shorter than the patella, tip of the cymbiobulbus broad.

Female. As in male except as noted. Habitus as in Fig. 3A, C, E. Body length 1.42. Endites without projections. Copulatory organ (Figs 3H, 23A, B): in the middle of the epigastric scutal ridge there is a dark, linguiform projection; postgynal depression extremely narrow; there is a paddle-like sclerite (pls) dorsally, with thin, smoothly curved arms; nail-like process (nlp) well separated.

Measurements. Male. TL: 1.20; CL: 0.55; CW: 0.49; AL: 0.70; AW: 0.56; ALE: 0.07; PME: 0.07; PLE: 0.06; EGW: 0.21; ALE-ALE: 0.02; ALE-PLE: 0.01; PME-PME: 0; PLE-PME: 0; CBL: 0.21; CBW: 0.07; PTL: 0.26; FI: 0.12; FML: 0.11.

Female. TL: 1.42; CL: 0.64; CW: 0.53; AL: 0.89; AW: 0.76; ALE: 0.08; PME: 0.07; PLE: 0.05; EGW: 0.21; ALE-ALE: 0.03; ALE-PLE: 0.01; PME-PME: 0; PLE-PME: 0.

Distribution. Kenya.

***Opopaea kulczynskii* (Berland, 1914)**

Figs 4–6, 22A–C, 23C, D, 25B, I

Gamasomorpha kulczynskii Berland, 1914: 80, figs 62–68 (♂) (syntypes 2 ♂, same locality as *Opopaea berlandi*, in Muséum national d'Histoire naturelle, not examined).

Opopaea kulczynskii: Brignoli 1975: 229; Saaristo and Marusik 2008: 28, figs 40–47, 191, 203, 206, 217, 233 (♂♀).

Material examined. 1 ♂ (NMK Ar-25097), 1 ♀ (NMK Ar-25098), Kenya, Makueni County, Kibwezi Town, Chyulu Hills National Park, Umani Springs, 02°27.968'S, 37°54.691'E, 979 m, 30.VII.2016, Kioko G.M., Yao Z. & Zhao Q.

Diagnosis. Males are recognized by the yellow palp and the very short palpal patella (Fig. 22A–C), females are recognized by the dark, ring-shaped spot on anterior edge of epigastric furrow and the long, fork-like arms of the paddle-like sclerite (Fig. 23C, D).

Description. Male. Yellow-brownish. Habitus as in Fig. 4A, C, E. Body length 1.33. Carapace (Fig. 4B): oval in dorsal view; sides with longitudinal streaks; dorsal area smooth, with some setae at lateral edges. Eyes: ALE largest, PLE smallest; posterior eye row straight viewed from above, procurved from front; ALE separated by less than their radius, ALE-PLE separated by less than ALE radius, PME touching throughout most of their length, PLE-PME separated by less than PME radius. Clypeus height about 0.6 times ALE diameter (Fig. 4G). Sternum (Fig. 4F) longer than wide, uni-

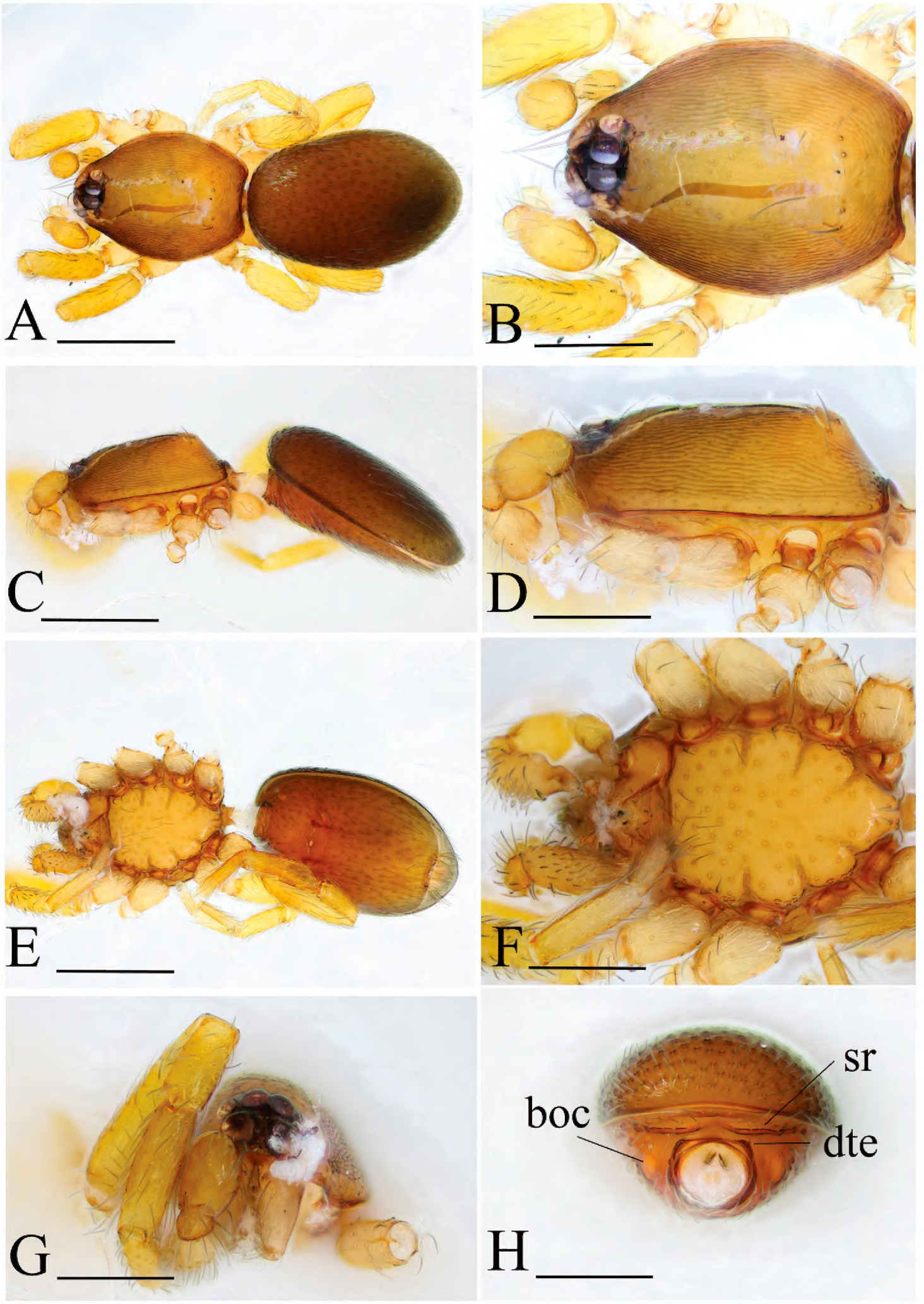

Figure 4. *Opopaea kulczynskii*, male. **A, C, E** habitus, dorsal, lateral and ventral views **B, D, F, G** prosoma, dorsal, lateral, ventral and anterior views **H** abdomen, anterior view. Abbreviations: boc = booklung covers; dte = dorsolateral, triangular extensions; sr = scutal ridge. Scale bars: 0.4 mm (**A, C, E**); 0.2 mm (**B, D, F–H**).

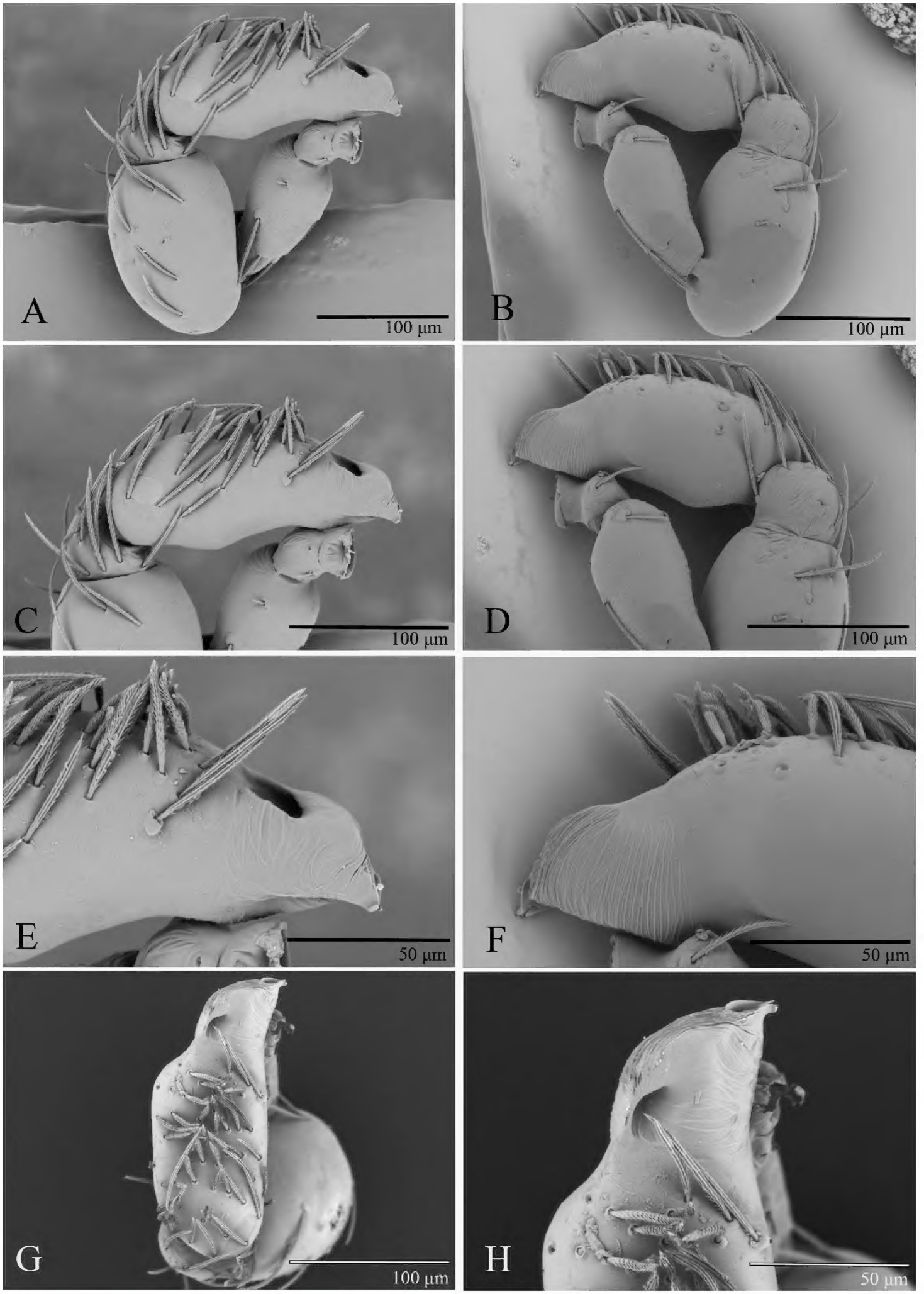

Figure 5. *Opopaea kulczynskii*, male left palp, SEM. **A, B** prolateral and retrolateral views **C, D, G** cymbiobulbus, prolateral, retrolateral and dorsal views **E, F, H** distal part of cymbiobulbus, prolateral, retrolateral and dorsal views.

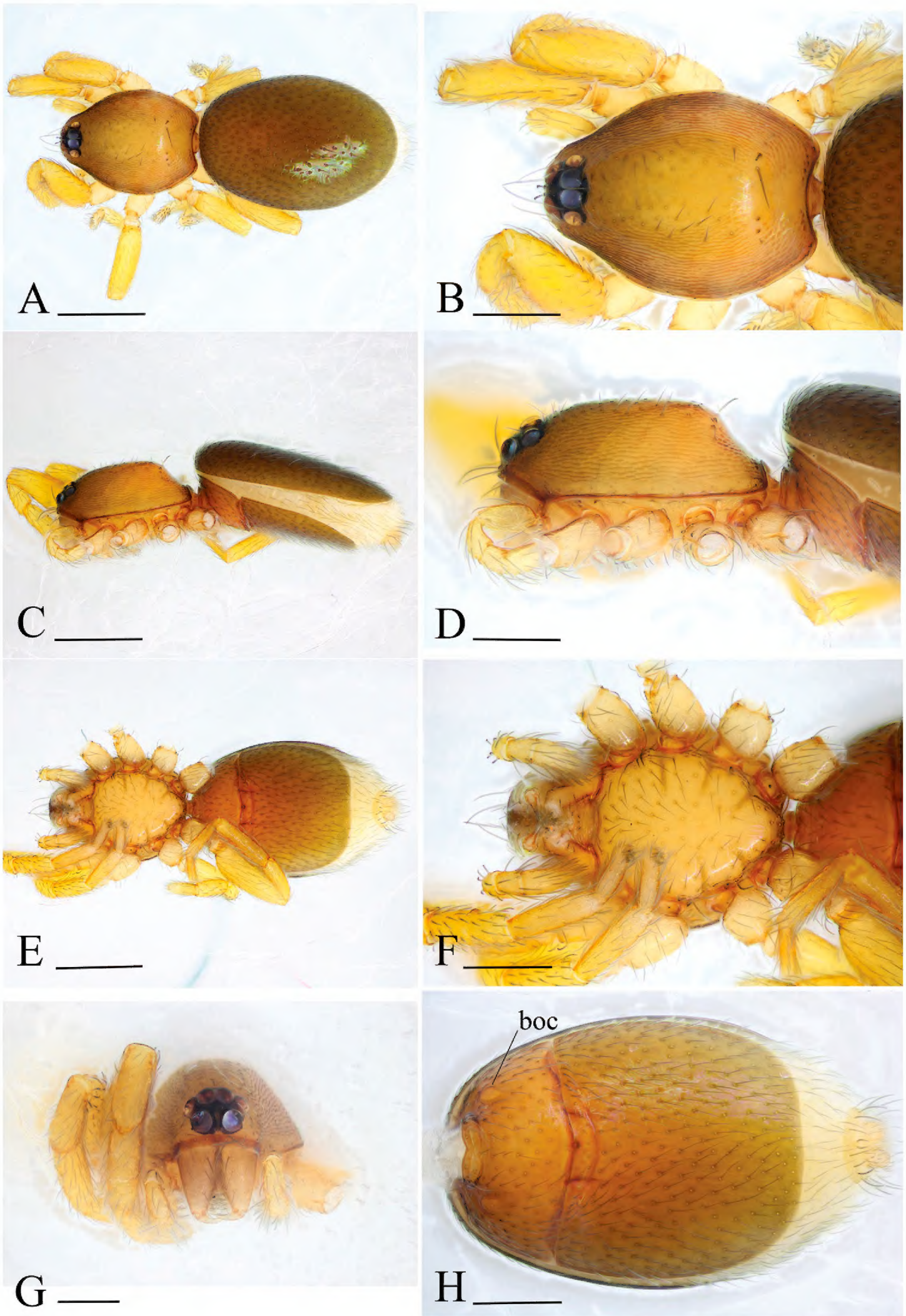

Figure 6. *Opopaea kulczynskii*, female. **A, C, E** habitus, dorsal, lateral and ventral views **B, D, F, G** prosoma, dorsal, lateral, ventral and anterior views **H** abdomen, ventral view. Abbreviation: boc = booklung covers. Scale bars: 0.4 mm (**A, C, E**); 0.2 mm (**B, D, F–H**).

form, fused to carapace; surface finely reticulate; radial furrows present between coxae, with rows of small pits. Anterior end of endites with a small, sharply pointed projection. Legs light yellow. Abdomen: booklung covers small, ovoid, without setae. Pedicel tube short, ribbed, with small, dorsolateral, triangular extensions, scuto-pedicel region lower than diameter of pedicel, with nearly straight scutal ridges and anterior scutal ridge (Fig. 4H). Palp (Figs 5, 22A–C): yellow; femur slightly shorter than the patella and inserted almost basally to patella; patella very short; cymbiobulbus longer than the patella, tip of the cymbiobulbus acute.

Female. As in male except as noted. Habitus as in Fig. 6A, C, E. Body length 1.60. Endites without projections. Copulatory organ (Figs 6H, 23C, D): in the middle of the epigastric furrow there is a dark, ring-shaped spot; there is a paddle-like sclerite (pls) dorsally, with long, fork-like arms; nail-like process (nlp) well separated.

Measurements. Male. TL: 1.33; CL: 0.60; CW: 0.44; AL: 0.73; AW: 0.49; ALE: 0.06; PME: 0.05; PLE: 0.04; EGW: 0.16; ALE-ALE: 0.02; ALE-PLE: 0.01; PME-PME: 0; PLE-PME: 0; CBL: 0.19; CBW: 0.08; PTL: 0.14; FI: 0.05; FML: 0.12.

Female. TL: 1.60; CL: 0.63; CW: 0.51; AL: 0.97; AW: 0.62; ALE: 0.06; PME: 0.05; PLE: 0.04; EGW: 0.16; ALE-ALE: 0.02; ALE-PLE: 0.01; PME-PME: 0; PLE-PME: 0.

Distribution. Kenya.

Opopaea makadara **Tong & Li, sp. nov.**
http://zoobank.org/A5512429-7071-4B04-A88F-3C4F712442F6
Figs 7–9, 21D–F, 24A, B, 25C, J

Type material. ***Holotype*** ♂ (NMK Ar-25110), Kenya, Kwale County, Ukunda Town, Shimba Hills National Reserve, Makadara Forest, 04°14.232'S, 39°23.666'E, 410 m, 19.VII.2016, Kioko G.M., Yao Z. & Zhao Q. ***Paratypes***: 1 ♂ (NMK Ar-25111), same data as holotype; 1 ♀ (NMK Ar-25112), same data as holotype; 1 ♀ (NMK Ar-25113), Kwale County, Ukunda Town, Shimba Hills National Reserve, Sheldrick falls, 04°17.121'S, 39°25.886'E, 127 m, 18.VII.2016, Kioko G.M., Yao Z. & Zhao Q.

Etymology. The specific name is a noun in apposition taken from the type locality.

Diagnosis. The new species is similar to *O. manongarivo* Andriamalala & Hormiga, 2013, but can be distinguished by the round tip of male palpal bulb (Fig. 8E) and the dark, small, linguiform projection in the middle of the female epigastric scutal ridge (Fig. 24A). *Opopaea manongarivo* has acute tip of male palpal bulb and smooth epigastric scutal ridge of female (Andriamalala and Hormiga 2013: figs 635, 643, 645).

Description. Male (holotype). Yellow. Habitus as in Fig. 7A, C, E. Body length 1.32. Carapace (Fig. 7B): wide oval in dorsal view; sides with longitudinal streaks; dorsal area finely reticulate with some setae at lateral edges. Eyes: ALE largest, PLE smallest; posterior eye row straight viewed from above, procurved from front; ALE separated by less than their radius, ALE-PLE separated by less than ALE radius, PME touching throughout most of their length, PLE-PME separated by less than PME radius. Cl-

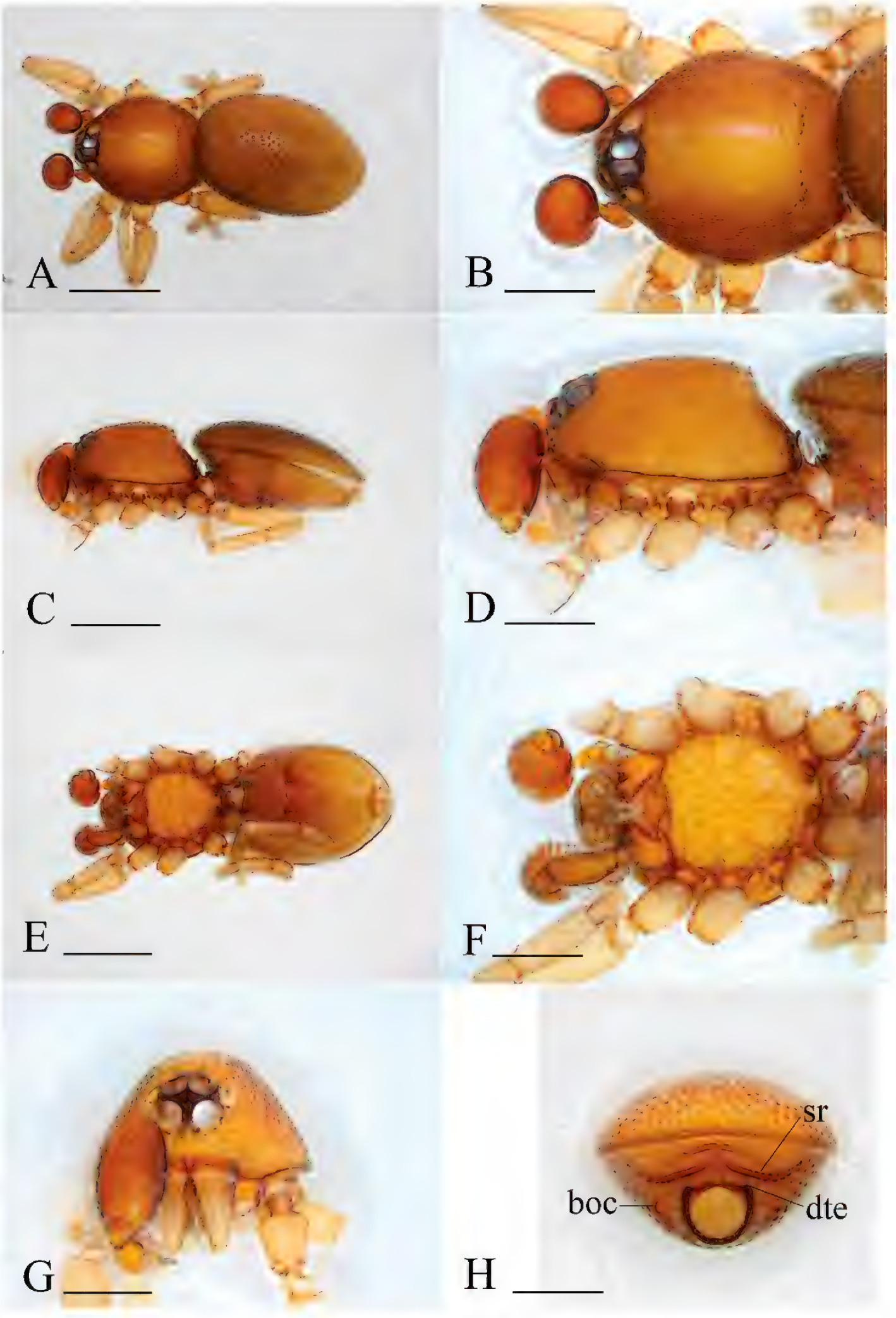

Figure 7. *Opopaea makadara* sp. nov., male. **A, C, E** habitus, dorsal, lateral and ventral views **B, D, F, G** prosoma, dorsal, lateral, ventral and anterior views **H** abdomen, anterior view. Abbreviations: boc = booklung covers; dte = dorsolateral, triangular extensions; sr = scutal ridge. Scale bars: 0.4 mm (**A, C, E**); 0.2 mm (**B, D, F–H**).

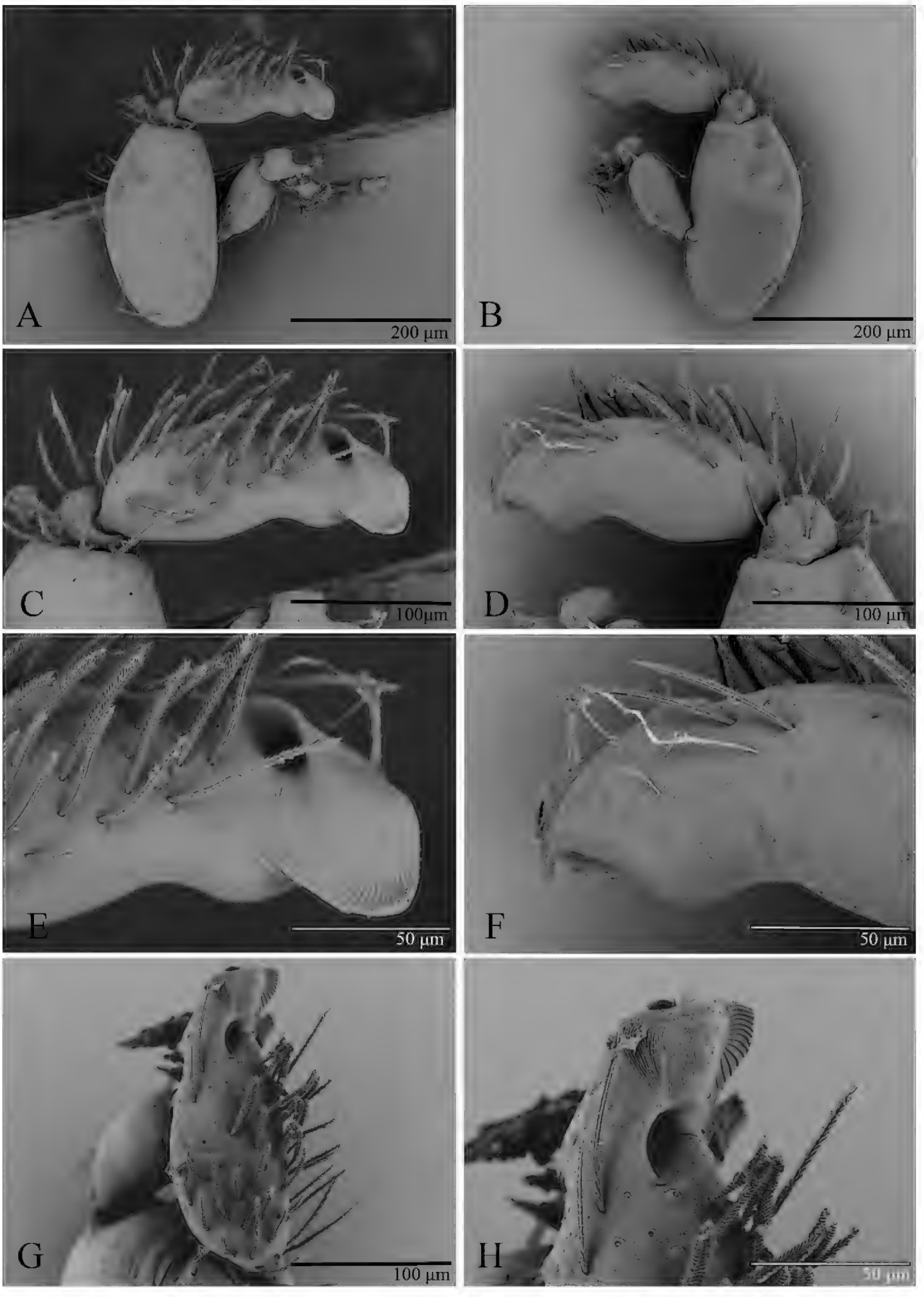

Figure 8. *Opopaea makadara* sp. nov., male left palp, SEM. **A, B** prolateral and retrolateral views **C, D, G** cymbiobulbus, prolateral, retrolateral and dorsal views **E, F, H** distal part of cymbiobulbus, prolateral, retrolateral and dorsal views.

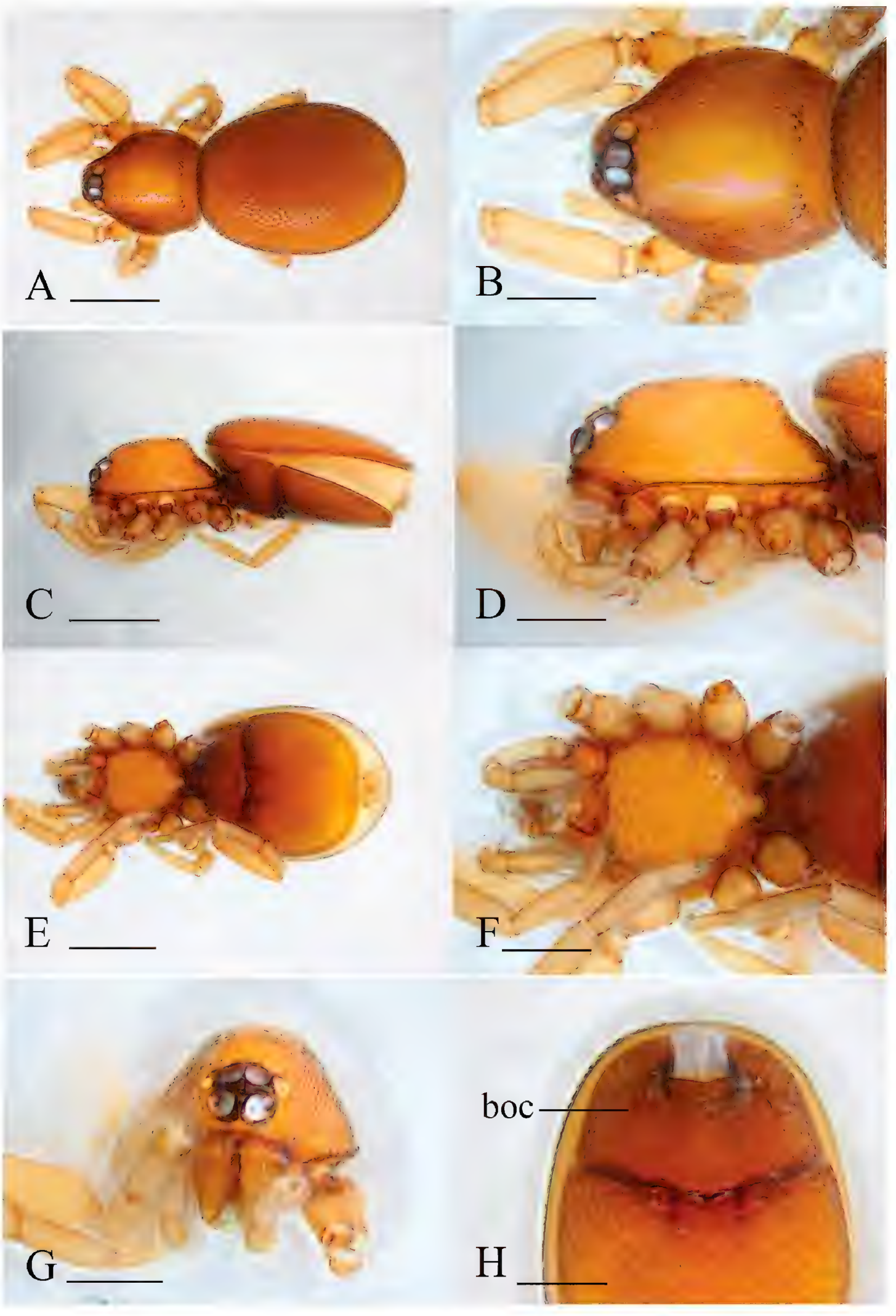

Figure 9. *Opopaea makadara* sp. nov., female. **A, C, E** habitus, dorsal, lateral and ventral views **B, D, F, G** prosoma, dorsal, lateral, ventral and anterior views **H** abdomen, ventral view. Abbreviation: boc = booklung covers. Scale bars: 0.4 mm (**A, C, E**); 0.2 mm (**B, D, F–H**).

ypeus height about 1.4 times ALE diameter (Fig. 7G). Sternum (Fig. 7F) as long as wide, fused to carapace; surface finely reticulate, with medium sized pits; radial furrows present. Anterior end of endites with a small, sharply pointed projection. Legs light yellow. Abdomen: booklung covers very small, ovoid, without setae. Pedicel tube short, ribbed, with small, dorsolateral, triangular extensions, scuto-pedicel region as high as diameter of pedicel, with arched scutal ridges, interrupted medially, with curved anterior scutal ridge (Fig. 7H). Palp (Figs 8, 21D–F): reddish brown; palpal femur slightly shorter than half the length of palpal patella and inserted at the patella submedially; patella very large; cymbiobulbus shorter than the patella; palpal fenestra large and located at one third the length of the palp. Tip of the palp with one large, round protuberance.

Female. As in male except as noted. Habitus as in Fig. 9A, C, E. Body length 1.50. Endites without projections. Copulatory organ (Figs 9H, 24A, B): in the middle of the epigastric scutal ridge there is a dark, small, linguiform projection; postgynal depression extremely narrow; there is a paddle-like sclerite (pls) dorsally, with thin straight arms; nail-like process (nlp) well separated.

Measurements. Male (holotype). TL: 1.32; CL: 0.58; CW: 0.50; AL: 0.77; AW: 0.56; ALE: 0.08; PME: 0.07; PLE: 0.06; EGW: 0.22; ALE-ALE: 0.02; ALE-PLE: 0.01; PME-PME: 0; PLE-PME: 0; CBL: 0.19; CBW: 0.08; PTL: 0.25; FI: 0.11; FML: 0.11.

Female. TL: 1.50; CL: 0.60; CW: 0.49; AL: 0.97; AW: 0.71; ALE: 0.08; PME: 0.06; PLE: 0.05; EGW: 0.21; ALE-ALE: 0.03; ALE-PLE: 0.01; PME-PME: 0; PLE-PME: 0.

Distribution. Known only from the type locality.

Opopaea ngangao Tong & Li, sp. nov.

http://zoobank.org/06BF945A-DDC5-4835-B974-CD6346D79009

Figs 10–12, 22D–F, 24C, D, 25E, K

Type material. ***Holotype*** ♂ (NMK Ar-25116), Kenya, Taita-Taveta County, Wundanyi Town, Taita Hills Blocks: Ngangao Forest-wet side, 03°21.299'S, 38°20.410'E, 1821 m, 23.VII.2016, Kioko G.M., Yao Z. & Zhao Q. ***Paratypes*:** 1 ♀ (NMK Ar-25117), same data as holotype; 1 ♂ (NMK Ar-25118), Taita-Taveta County, Wundanyi Town, Taita Hills Blocks: Ngangao Forest-dry side, 03°21.248'S, 38°20.288'E, 1832 m, 24.VII.2016, Kioko G.M., Yao Z. & Zhao Q.

Etymology. The specific name is a noun in apposition taken from the type locality.

Diagnosis. The new species is very similar to *O. hoplites* (Berland, 1914), but can be distinguished by the large, curved protuberance on the tip of the male palp (Figs 11E, 22D), and the very narrow postgynal depression of female epigastric region (Fig. 24C). *Opopaea hoplites* has a small protuberance on the tip of the male palp and a very large postgynal depression of female (Saaristo and Marusik 2008: figs 34, 37B).

Description. Male (holotype). Reddish brown. Habitus as in Fig. 10A, C, E. Body length 2.08. Carapace (Fig. 10B): wide oval in dorsal view; sides with longitu-

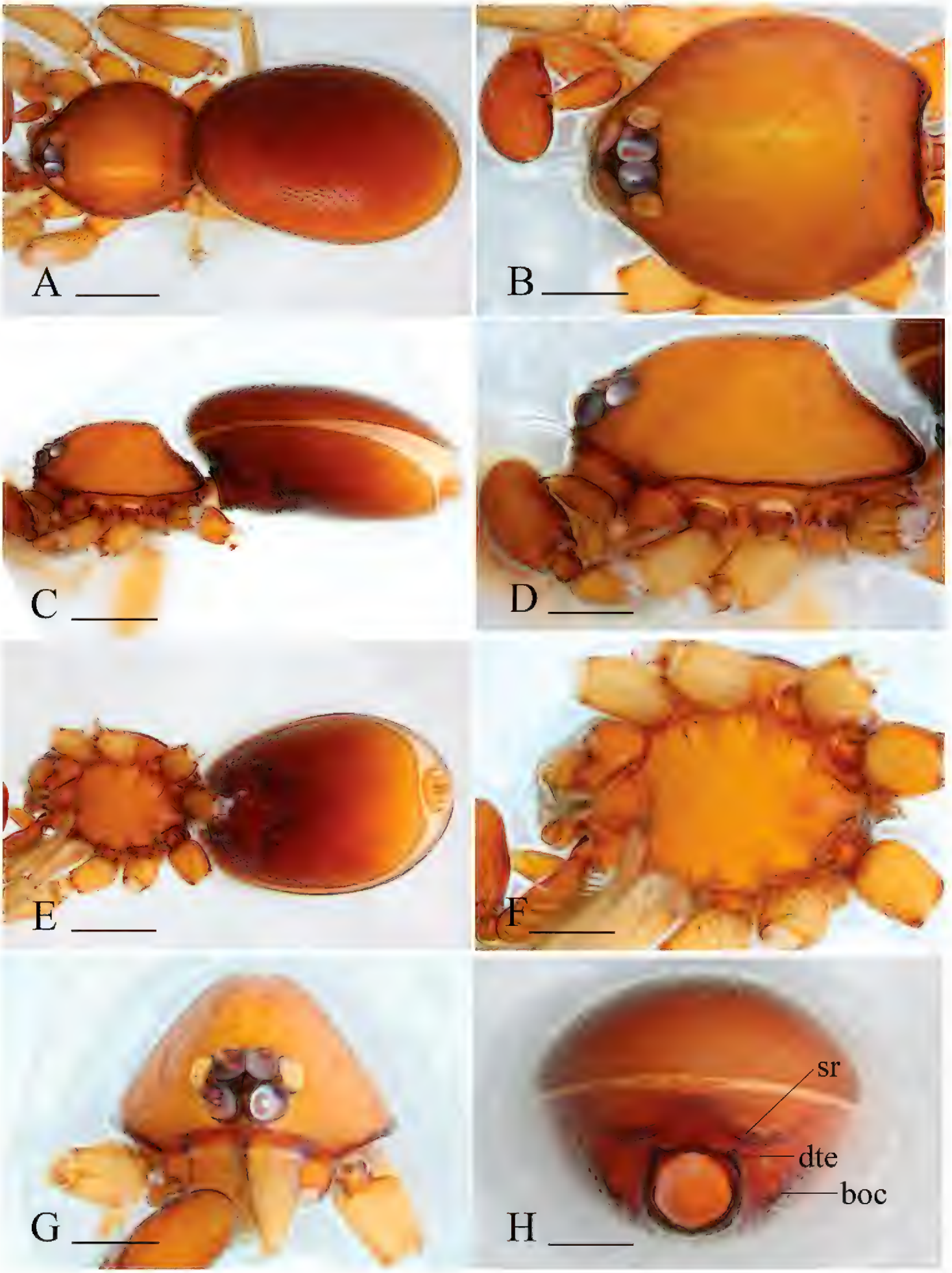

Figure 10. *Opopaea ngangao* sp. nov., male. **A, C, E** habitus, dorsal, lateral and ventral views **B, D, F, G** prosoma, dorsal, lateral, ventral and anterior views **H** abdomen, anterior view. Abbreviations: boc = booklung covers; dte = dorsolateral, triangular extensions; sr = scutal ridge. Scale bars: 0.4 mm (**A, C, E**); 0.2 mm (**B, D, F–H**).

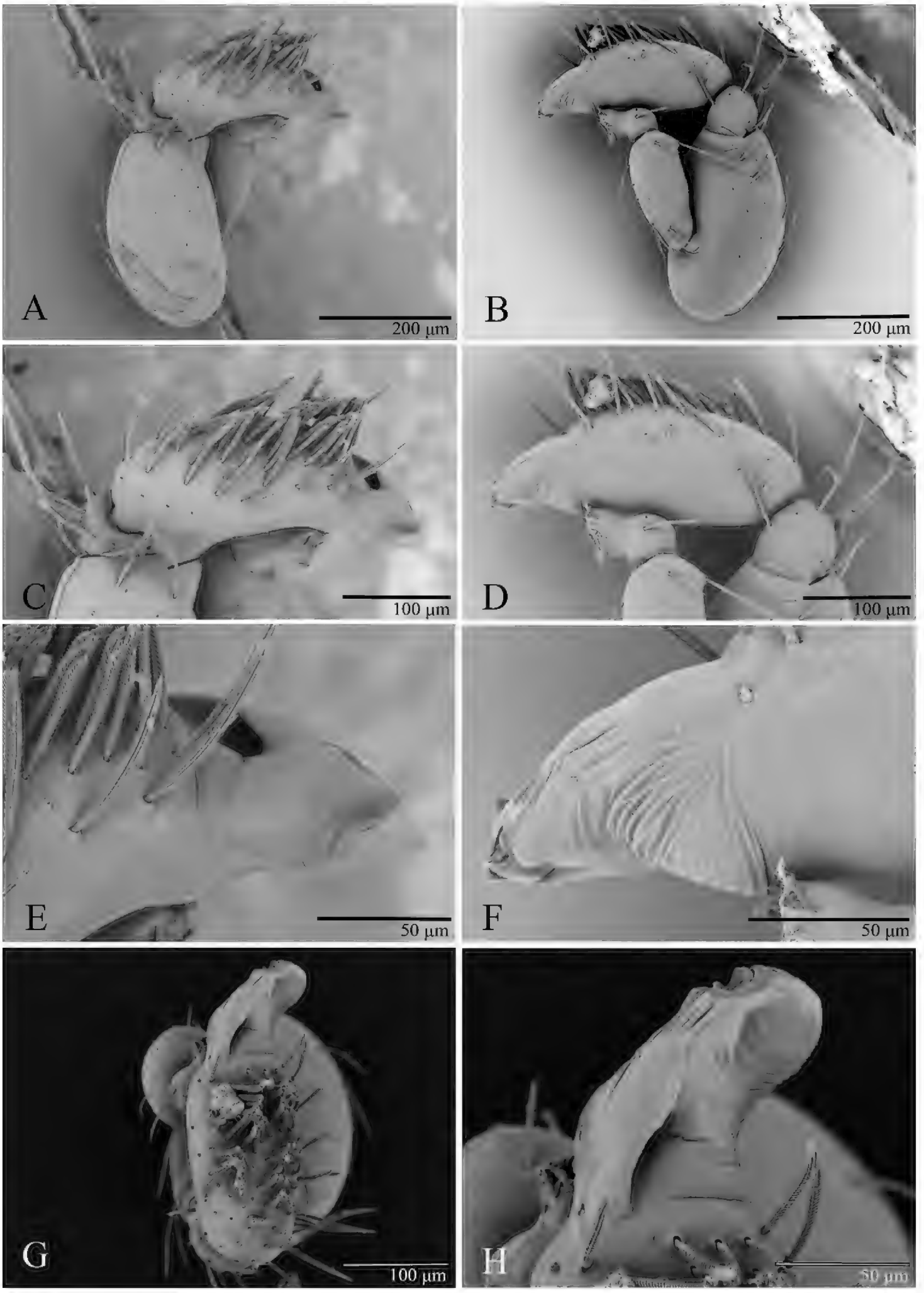

Figure 11. *Opopaea ngangao* sp. nov., male left palp, SEM. **A, B** prolateral and retrolateral views **C, D, G** cymbiobulbus, prolateral, retrolateral and dorsal views **E, F, H** distal part of cymbiobulbus, prolateral, retrolateral and dorsal views.

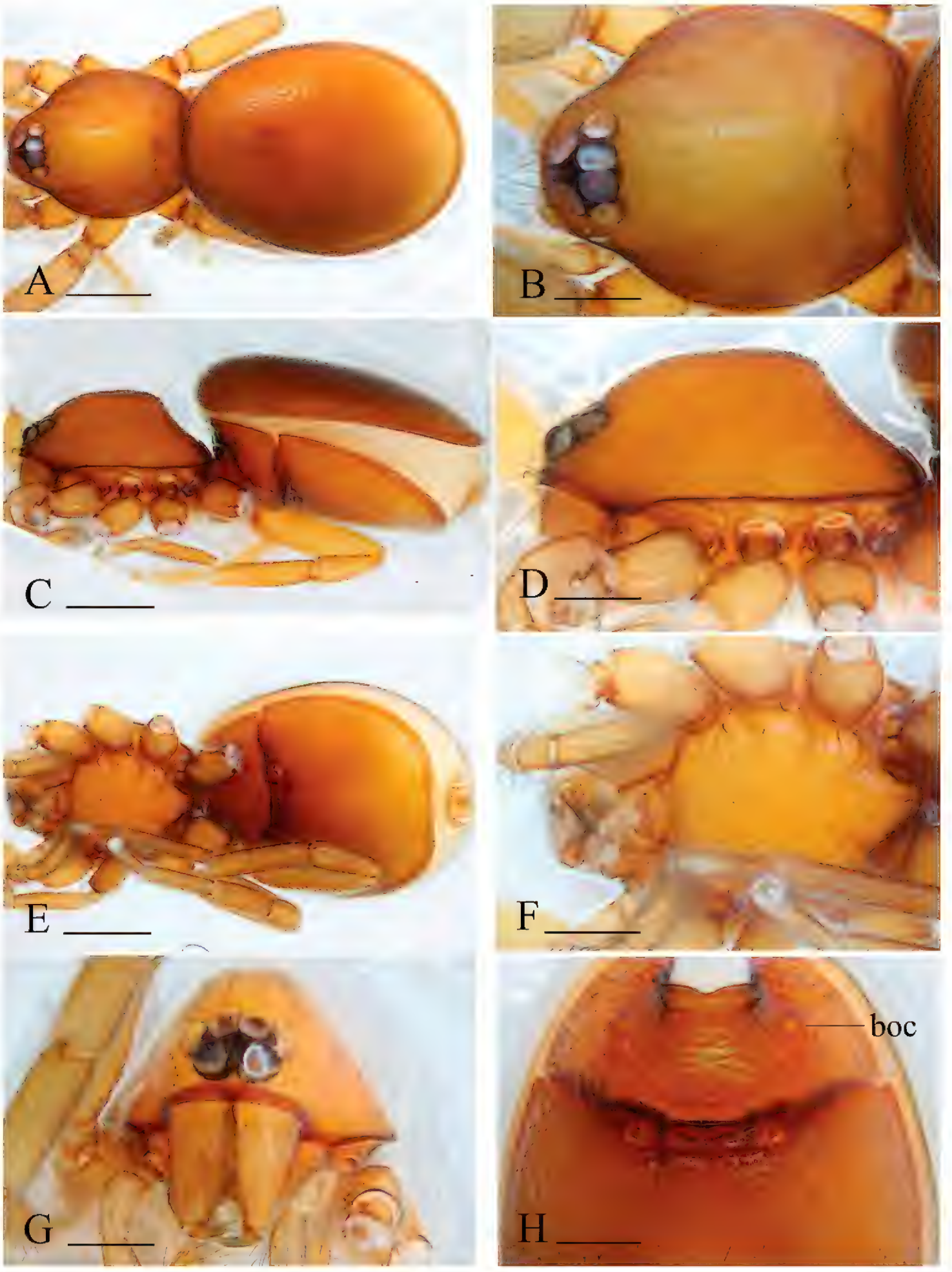

Figure 12. *Opopaea ngangao* sp. nov., female. **A, C, E** habitus, dorsal, lateral and ventral views **B, D, F, G** prosoma, dorsal, lateral, ventral and anterior views **H** abdomen, ventral view. Abbreviation: boc = booklung covers. Scale bars: 0.4 mm (**A, C, E**); 0.2 mm (**B, D, F–H**).

dinal streaks; dorsal area smooth, with some setae at lateral edges. Eyes: ALE largest, PLE smallest; posterior eye row recurved viewed from above, procurved from front; ALE separated by less than their radius, ALE-PLE separated by less than ALE radius, PME touching throughout most of their length, PLE-PME separated by less than PME radius. Clypeus height about 0.9 times ALE diameter (Fig. 10G). Sternum (Fig. 10F) longer than wide, fused to carapace; surface smooth; radial furrows present. Anterior end of endites with a small, sharply pointed projection. Legs light yellow. Abdomen: booklung covers very small, ovoid, without setae. Pedicel tube short, ribbed, with large, dorsolateral, triangular extensions, scuto-pedicel region lower than diameter of pedicel, with arched scutal ridges and straight anterior scutal ridge (Fig. 10H). Palp (Figs 11, 22D–F): reddish brown; palpal femur about two thirds the length of patella and inserted at the patella submedially; patella large; cymbiobulbus as long as the patella; palpal fenestra large and located at nearly the tip of the palp. Tip of the palp with one large, curved protuberance.

Female. As in male except as noted. Habitus as in Fig. 12A, C, E. Body length 2.19. Endites without projections. Copulatory organ (Figs 12H, 24C, D): postgynal depression narrow, about one second the length between epigastric furrow and the shallow groove connecting tracheal spiracles; there is a paddle-like sclerite (pls) dorsally, with thin, fork-shaped arms; nail-like process (nlp) well separated.

Measurements. Male (holotype). TL: 2.08; CL: 0.83; CW: 0.68; AL: 1.34; AW: 0.87; ALE: 0.11; PME: 0.09; PLE: 0.08; EGW: 0.26; ALE-ALE: 0.03; ALE-PLE: 0.01; PME-PME: 0; PLE-PME: 0; CBL: 0.29; CBW: 0.11; PTL: 0.29; FI: 0.11; FML: 0.18.

Female. TL: 2.19; CL: 0.93; CW: 0.73; AL: 1.36; AW: 1.04; ALE: 0.10; PME: 0.09; PLE: 0.08; EGW: 0.27; ALE-ALE: 0.04; ALE-PLE: 0.01; PME-PME: 0; PLE-PME: 0.

Distribution. Known only from the type locality.

Opopaea ngulia Tong & Li, sp. nov.

http://zoobank.org/8CCF1548-DA9C-4FE3-83C3-77C7A7BC647A

Figs 13, 14, 21G–I, 25D

Type material. ***Holotype*** ♂ (NMK Ar-25114), Kenya, Taita-Taveta County, Mtito andei Town, Tsavo West National Park, Ngulia lodge intake, 03°01.528'S, 38°12.091'E, 1036 m, 28.VII.2016, Kioko G.M., Yao Z. & Zhao Q.

Etymology. The specific name is a noun in apposition taken from the type locality.

Diagnosis. The new species is similar to *O. simoni* (Berland, 1914), but can be distinguished by the small body size and the cymbiobulbus which is shorter than the patella (Fig. 21G). *Opopaea simoni* has large body size and the cymbiobulbus is as long as the patella (Saaristo and Marusik 2008: figs 85, 90).

Description. Male (holotype). Yellow. Habitus as in Fig. 13A, C, E. Body length 1.51. Carapace (Fig. 13B): oval in dorsal view; sides with longitudinal streaks; dor-

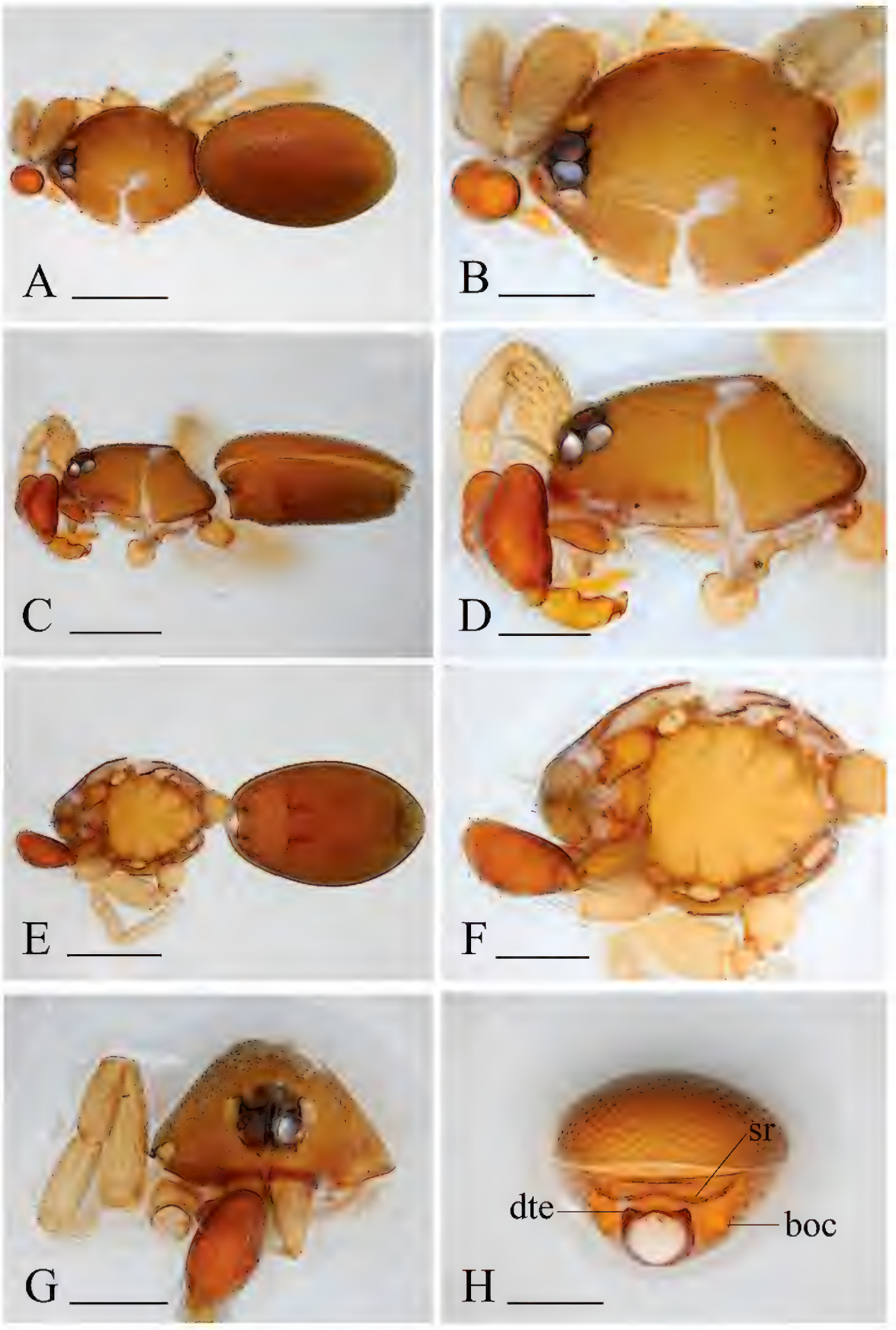

Figure 13. *Opopaea ngulia* sp. nov., male. **A, C, E** habitus, dorsal, lateral and ventral views **B, D, F, G** prosoma, dorsal, lateral, ventral and anterior views **H** abdomen, anterior view. Abbreviations: boc = booklung covers; dte = dorsolateral, triangular extensions; sr = scutal ridge. Scale bars: 0.4 mm (**A, C, E**); 0.2 mm (**B, D, F–H**).

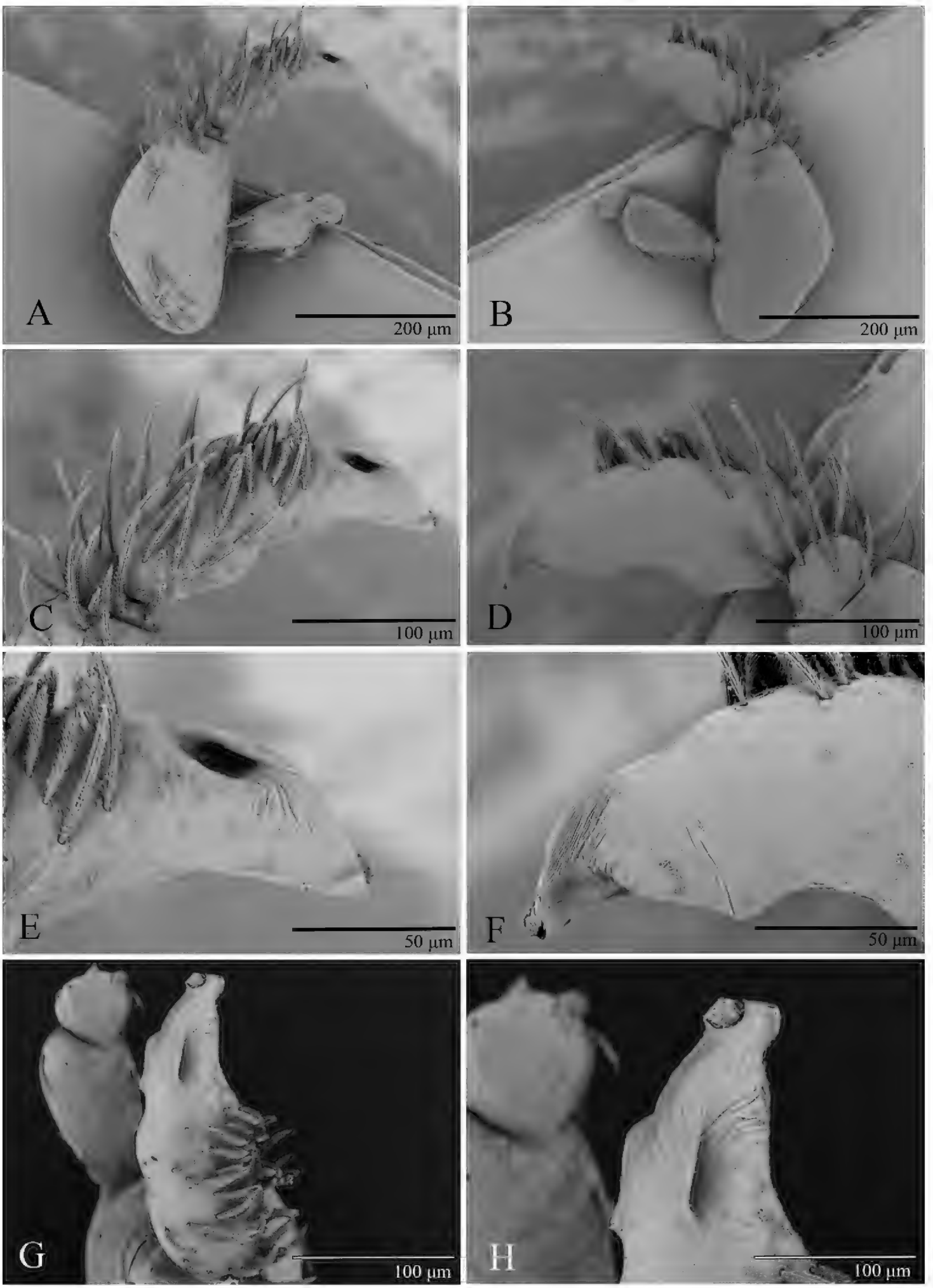

Figure 14. *Opopaea ngulia* sp. nov., male left palp, SEM. **A, B** prolateral and retrolateral views **C, D, G** cymbiobulbus, prolateral, retrolateral and dorsal views **E, F, H** distal part of cymbiobulbus, prolateral, retrolateral and dorsal views.

sal area granulate, with some hairs at lateral edges. Eyes: ALE largest, PLE smallest; posterior eye row recurved viewed from above, procurved from front; ALE separated by less than their radius, ALE-PLE separated by less than ALE radius, PME touching throughout most of their length, PLE-PME separated by less than PME radius. Clypeus height about 1.3 times ALE diameter (Fig. 13G). Sternum (Fig. 13F) as long as wide, fused to carapace; surface finely reticulate; radial furrows present, with rows of small pits. Anterior end of endites with a small, sharply pointed projection. Legs light yellow. Abdomen: booklung covers small, ovoid, without setae. Pedicel tube short, ribbed, with large, dorsolateral, triangular extensions, scuto-pedicel region lower than diameter of pedicel, with arched scutal ridges and straight anterior scutal ridge (Fig. 13H). Palp (Figs 14, 21G–I): reddish brown; palpal femur about half the length of patella and inserted at the patella submedially; patella strongly bumped dorsally; cymbiobulbus shorter than the patella; palpal fenestra large and located near the tip of the bulb. Tip of the palp with a small protuberance.

Female. Unknown.

Measurements. Male (holotype). TL: 1.51; CL: 0.67; CW: 0.52; AL: 0.87; AW: 0.54; ALE: 0.07; PME: 0.06; PLE: 0.05; EGW: 0.21; ALE-ALE: 0.02; ALE-PLE: 0.01; PME-PME: 0; PLE-PME: 0; CBL: 0.20; CBW: 0.08; PTL: 0.23; FI: 0.12; FML: 0.12.

Distribution. Known only from the type locality.

***Opopaea sheldrick* Tong & Li, sp. nov.**

http://zoobank.org/88490DE4-1960-4276-A333-4C141035A9E7

Figs 15–17, 21J–L, 23E, F, 25F, L

Type material. ***Holotype*** ♂ (NMK Ar-25130), Kenya, Kwale County, Ukunda Town, Shimba Hills National Reserve, Shimba Hills Sheldrick falls, 04°17.121'S, 39°25.886'E, 127 m, 18.VII.2016, Kioko G.M., Yao Z. & Zhao Q. ***Paratypes*:** 1 ♀ (NMK Ar-25125), same data as holotype; 2 ♂ (NMK Ar-25126-25127), 2 ♀ (NMK Ar-25128-25129), same data as holotype.

Etymology. The specific name is a noun in apposition taken from the type locality.

Diagnosis. The new species is similar to *O. antsiranana* Andriamalala & Hormiga, 2013, but can be distinguished by the hook-like protuberance on the tip of the male palp (Fig. 16E) and the triangular postgynal depression of female (Fig. 23E). *Opopaea antsiranana* has a slightly curved male palp tip and very short and narrow postgynal depression of female (Andriamalala and Hormiga 2013: figs 318, 323, 326, 328).

Description. Male (holotype). yellowish brown. Habitus as in Fig. 15A, C, E. Body length 1.75. Carapace (Fig. 15B): oval in dorsal view; sides with longitudinal streaks; dorsal area granulate, with some hairs at lateral edges. Eyes: ALE largest, PLE smallest; posterior eye row procurved viewed from above, procurved from front; ALE separated by less than their radius, ALE-PLE separated by less than ALE radius, PME touching throughout most of their length, PLE-PME separated by less than PME radius. Clypeus height about 1.2 times ALE diameter (Fig. 15G). Sternum (Fig. 15F)

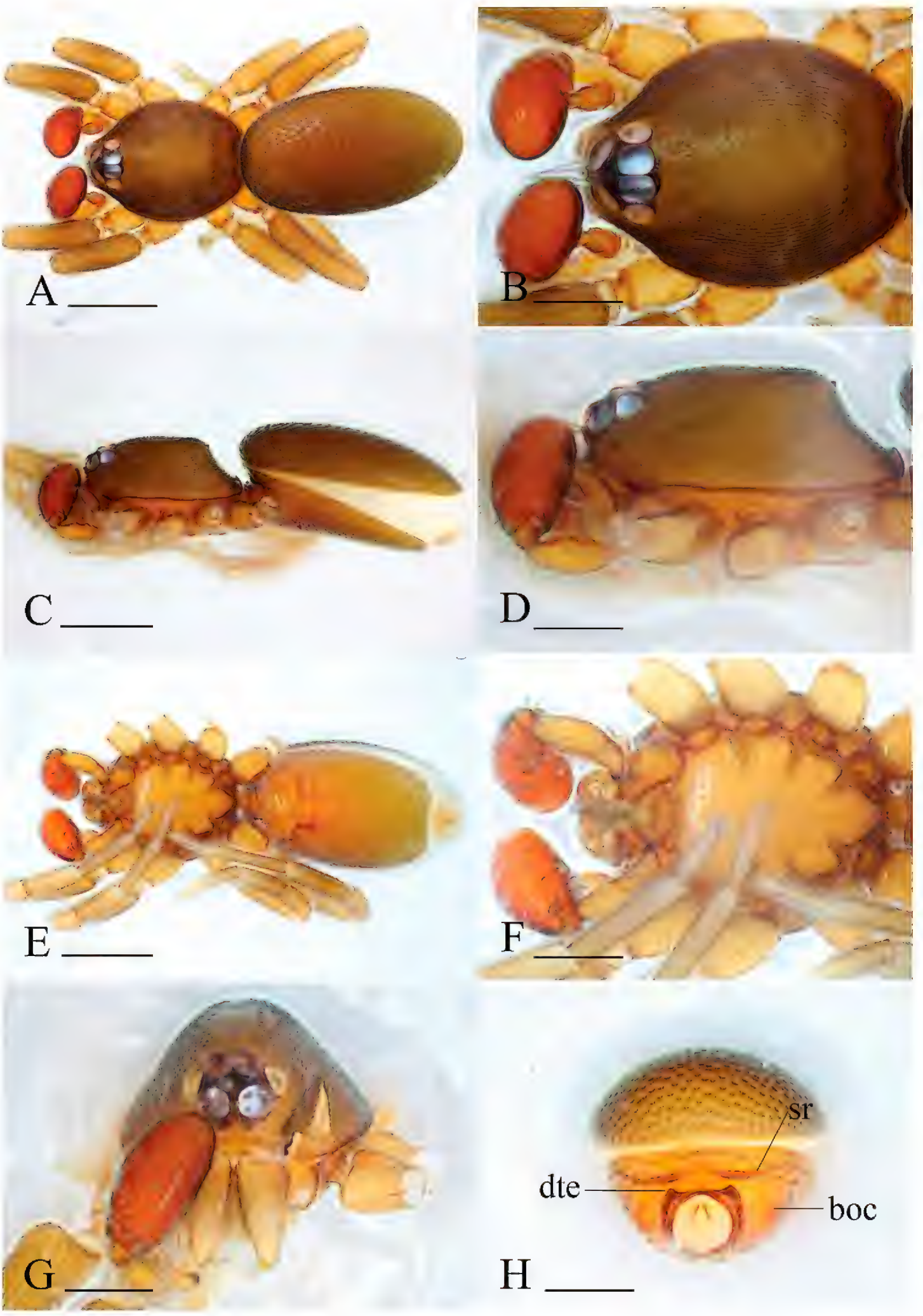

Figure 15. *Opopaea sheldrick* sp. nov., male. **A, C, E** habitus, dorsal, lateral and ventral views **B, D, F, G** prosoma, dorsal, lateral, ventral and anterior views **H** abdomen, anterior view. Abbreviations: boc = booklung covers; dte = dorsolateral, triangular extensions; sr = scutal ridge. Scale bars: 0.4 mm (**A, C, E**); 0.2 mm (**B, D, F–H**).

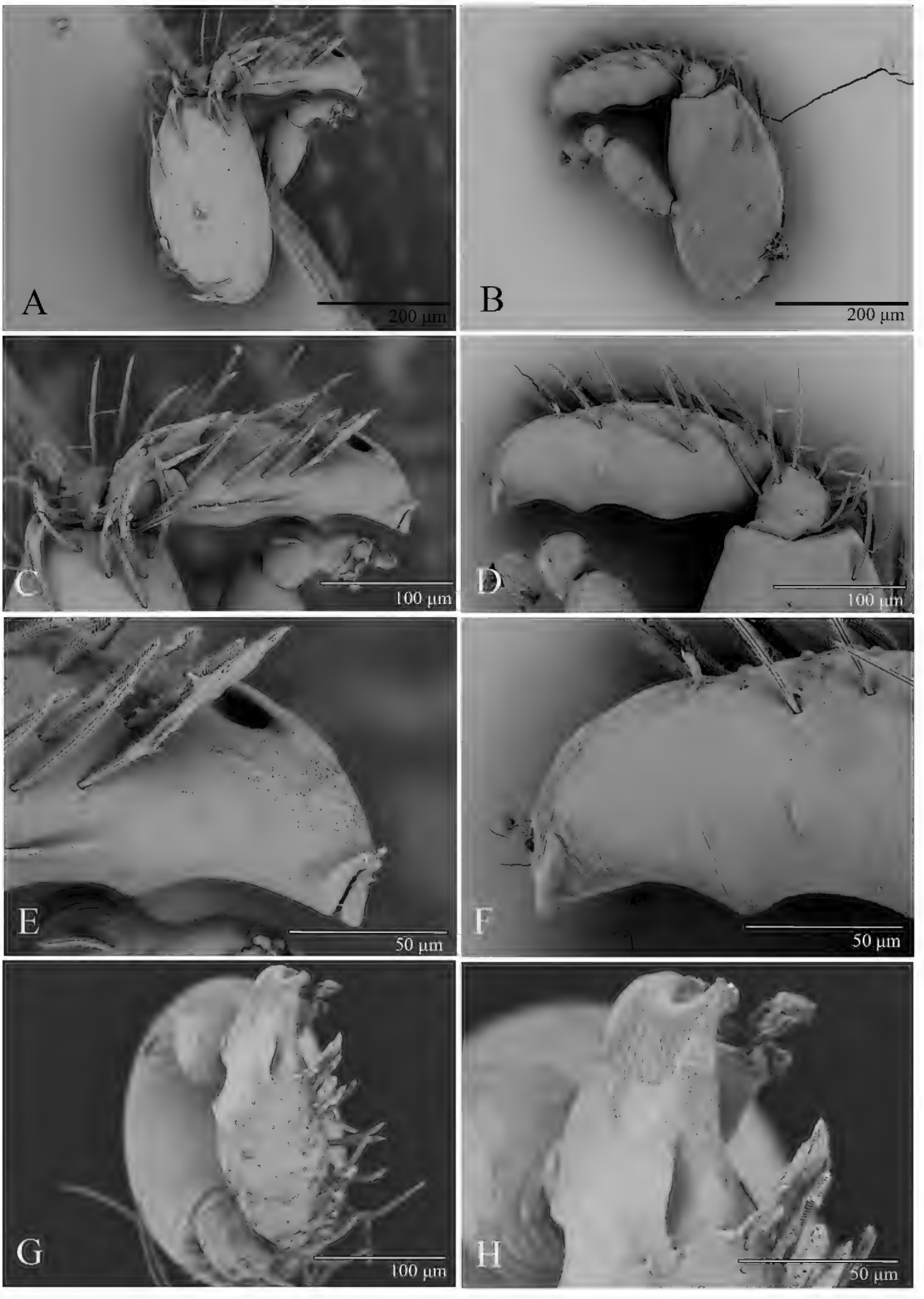

Figure 16. *Opopaea sheldrick* sp. nov., male left palp, SEM. **A, B** prolateral and retrolateral views **C, D, G** cymbiobulbus, prolateral, retrolateral and dorsal views **E, F, H** distal part of cymbiobulbus, prolateral, retrolateral and dorsal views.

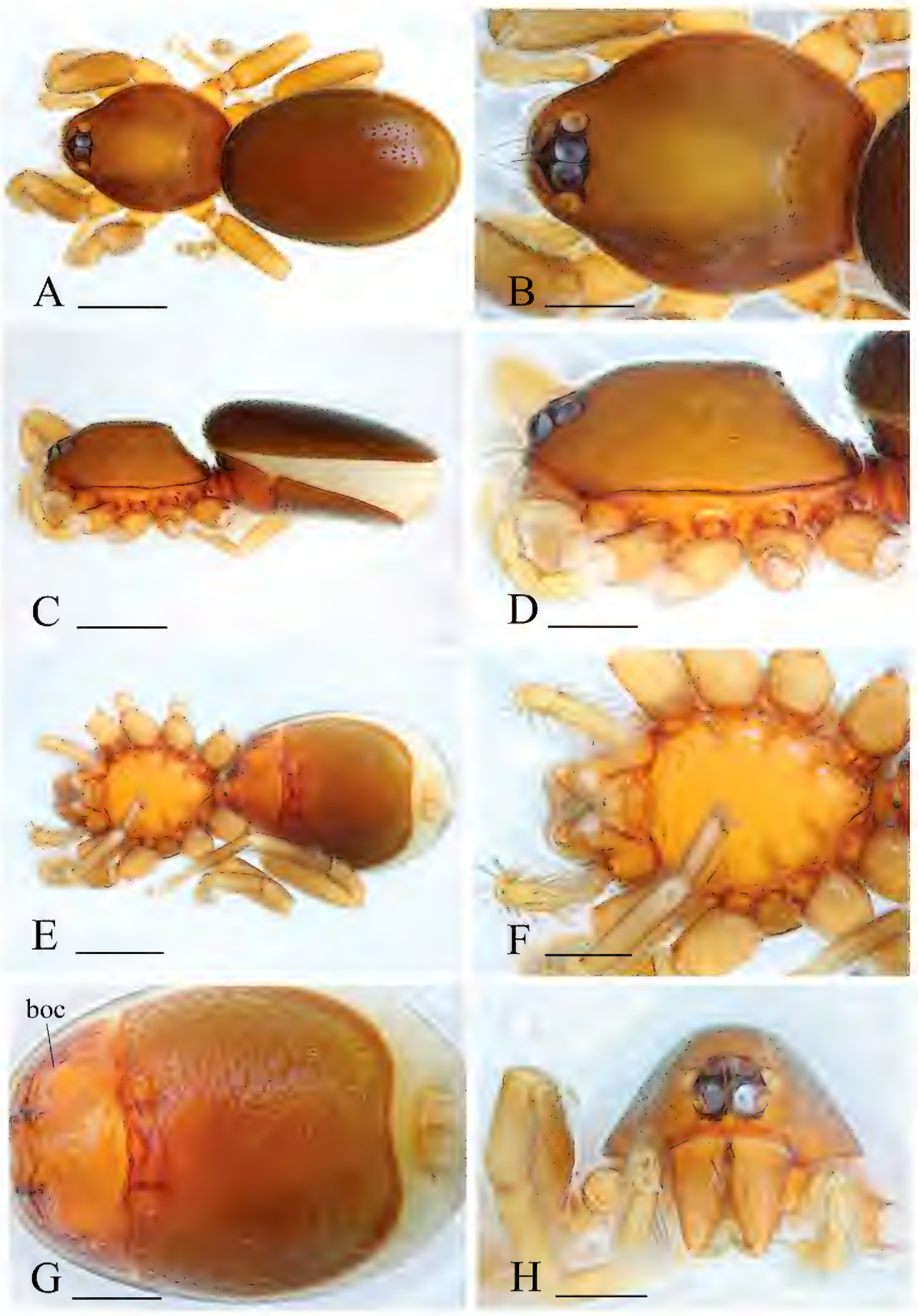

Figure 17. *Opopaea sheldrick* sp. nov., female. **A, C, E** habitus, dorsal, lateral and ventral views **B, D, F, H** prosoma, dorsal, lateral, ventral and anterior views **G** abdomen, ventral view. Abbreviation: boc = booklung covers. Scale bars: 0.4 mm (**A, C, E**); 0.2 mm (**B, D, F–H**).

longer than wide, fused to carapace; surface finely reticulate; radial furrows present, with rows of small pits. Anterior end of endites with a small, sharply pointed projection. Legs light yellow. Abdomen: booklung covers small, ovoid, without setae. Pedicel tube short, ribbed, with small, dorsolateral, triangular extensions, scuto-pedicel region lower than diameter of pedicel, with nearly straight scutal ridges (Fig. 15H). Palp (Figs 16, 21J–L): reddish brown; palpal femur less than half the length of patella and inserted at the patella submedially; patella large; cymbiobulbus shorter than the patella; palpal fenestra small and located at nearly the tip of the palp. Tip of the palp with a hook-like protuberance.

Female. As in male except as noted. Habitus as in Fig. 17A, C, E. Body length 1.85. Endites without projections. Copulatory organ (Figs 17G, 23E, F): postgynal depression small, triangular, about one third the width between the lateral apodemes; with a short, stick-shaped dark mark in the depression; there is a paddle-like sclerite (pls) dorsally, with thin, long, distal curved arms; nail-like process (nlp) well separated.

Measurements. Male (holotype). TL: 1.75; CL: 0.72; CW: 0.58; AL: 1.04; AW: 0.60; ALE: 0.10; PME: 0.08; PLE: 0.07; EGW: 0.23; ALE-ALE: 0.02; ALE-PLE: 0.01; PME-PME: 0; PLE-PME: 0; CBL: 0.24; CBW: 0.09; PTL: 0.32; FI: 0.14; FML: 0.13.

Female. TL: 1.85; CL: 0.77; CW: 0.61; AL: 1.12; AW: 0.76; ALE: 0.09; PME: 0.07; PLE: 0.06; EGW: 0.23; ALE-ALE: 0.02; ALE-PLE: 0.01; PME-PME: 0; PLE-PME: 0.

Distribution. Known only from the type locality.

Opopaea wundanyi Tong & Li, sp. nov.

http://zoobank.org/5EF5E6DC-A4F2-4B51-A4D0-5EC607CED355

Figs 18–20, 22G–I, 24E, F, 25G, M

Type material. Holotype ♂ (NMK Ar-25121), Kenya, Taita-Taveta County, Wundanyi Town, Taita Hills Blocks: Ngangao Forest-dry side, 03°21.248'S, 38°20.288'E, 1832 m, 24.VII.2016, Kioko G.M., Yao Z. & Zhao Q. Paratypes: 1 ♀ (NMK Ar-25122), same data as holotype; 1 ♂ (NMK Ar-25123), 1 ♀ (NMK Ar-25124), same data as holotype.

Etymology. The specific name is a noun in apposition taken from the type locality.

Diagnosis. The new species is similar to *O. kirindy* Andriamalala & Hormiga, 2013, but can be distinguished by the blackish brown body color, the small eyes' size, the cymbiobulbus is shorter than male palpal patella (Figs 19A, B, 22G, H) and with paddle-like sclerite of the female copulatory organ (Fig. 24F). *Opopaea kirindy* has dark orange body color, large eyes' size, the cymbiobulbus is longer than male palpal patella and without paddle like sclerite of female copulatory organ (Andriamalala and Hormiga 2013: figs 526, 527, 532, 533).

Description. Male (holotype). Blackish brown. Habitus as in Fig. 18A, C, E. Body length 1.90. Carapace (Fig. 18B): wide oval in dorsal view; sides with longi-

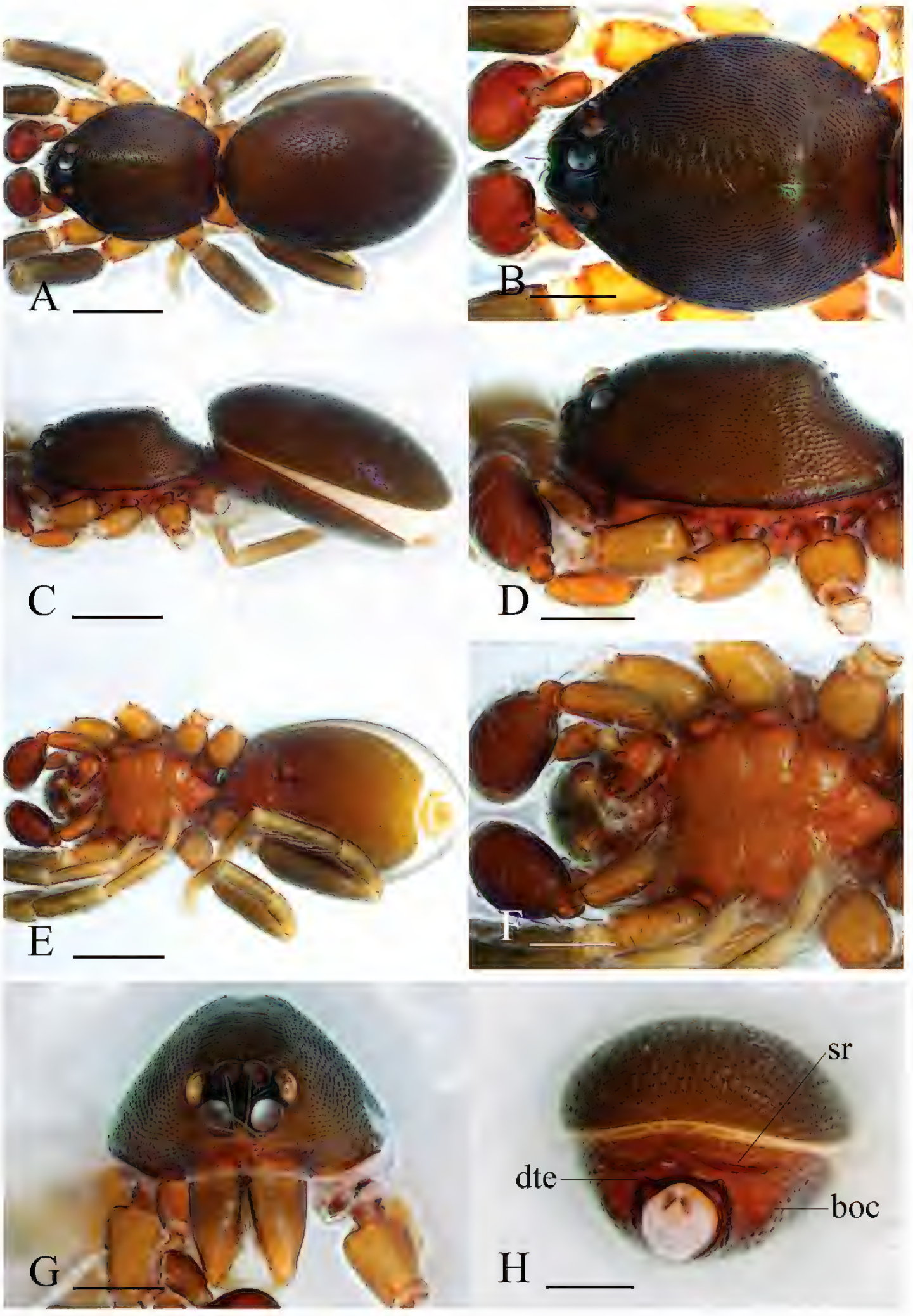

Figure 18. *Opopaea wundanyi* sp. nov., male. **A, C, E** habitus, dorsal, lateral and ventral views **B, D, F, G** prosoma, dorsal, lateral, ventral and anterior views **H** abdomen, anterior view. Abbreviations: boc = booklung covers; dte = dorsolateral, triangular extensions; sr = scutal ridge. Scale bars: 0.4 mm (**A, C, E**); 0.2 mm (**B, D, F–H**).

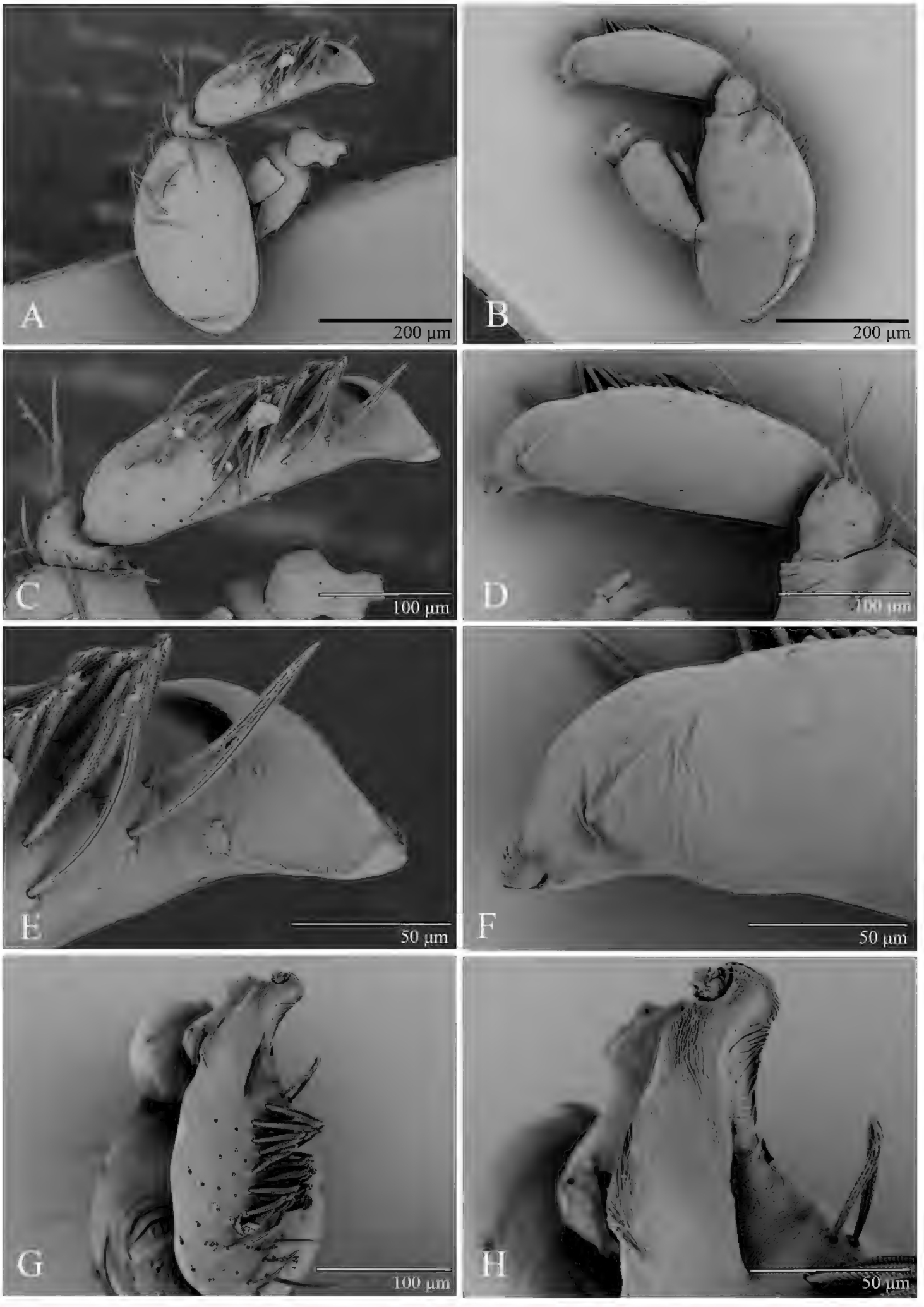

Figure 19. *Opopaea wundanyi* sp. nov., male left palp, SEM. **A, B** prolateral and retrolateral views **C, D, G** cymbiobulbus, prolateral, retrolateral and dorsal views **E, F, H** distal part of cymbiobulbus, prolateral, retrolateral and dorsal views.

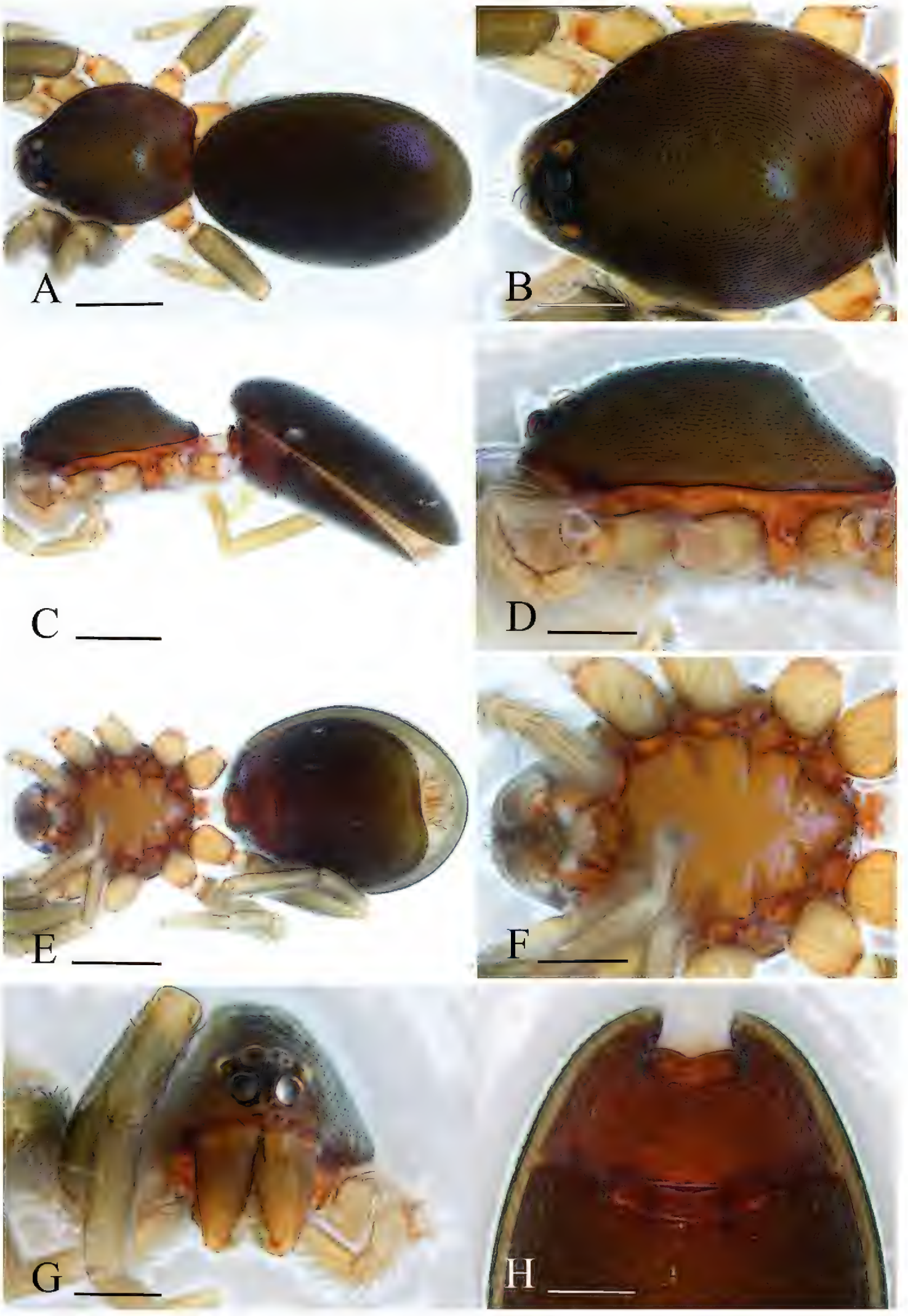

Figure 20. *Opopaea wundanyi* sp. nov., female. **A, C, E** habitus, dorsal, lateral and ventral views **B, D, F, G** prosoma, dorsal, lateral, ventral and anterior views **H** abdomen, ventral view. Scale bars: 0.4 mm (**A, C, E**); 0.2 mm (**B, D, F–H**).

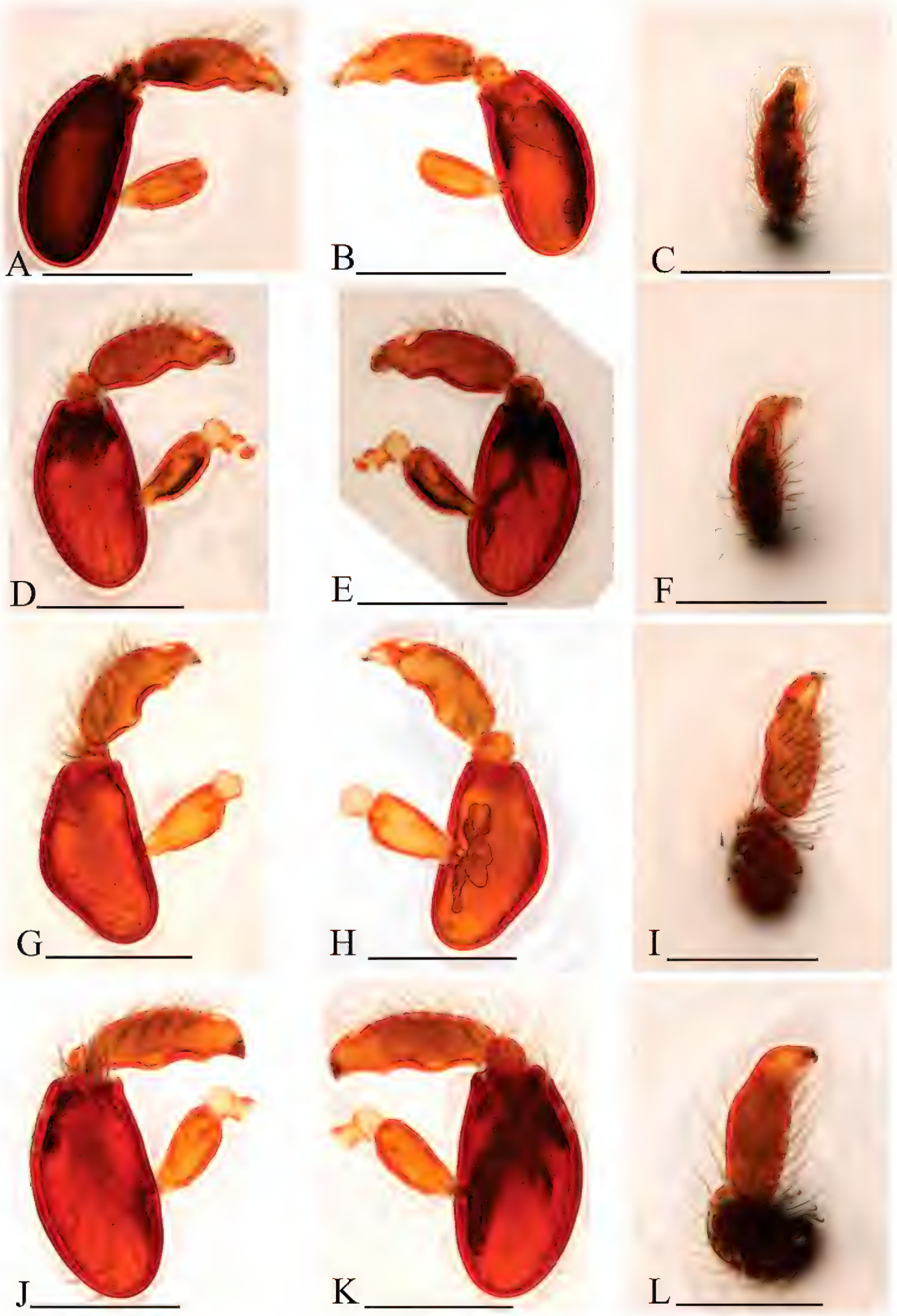

Figure 21. Male left palp. **A–C** *Opopaea berlandi* **D–F** *Opopaea makadara* sp. nov. **G–I** *Opopaea ngulia* sp. nov. **J–L** *Opopaea sheldrick* sp. nov. **A, D, G, J** prolateral view **B, E, H, K** retrolateral view **C, F, I, L** dorsal view. Scale bars: 0.2 mm.

Figure 22. Male left palp. **A–C** *Opopaea kulczynskii* **D–F** *Opopaea ngangao* sp. nov. **G–I** *Opopaea wundanyi* sp. nov. **A, D, G** prolateral view **B, E, H** retrolateral view **C, F, I** dorsal view. Scale bars: 0.1 mm (**A–C**); 0.2 mm (**D–I**).

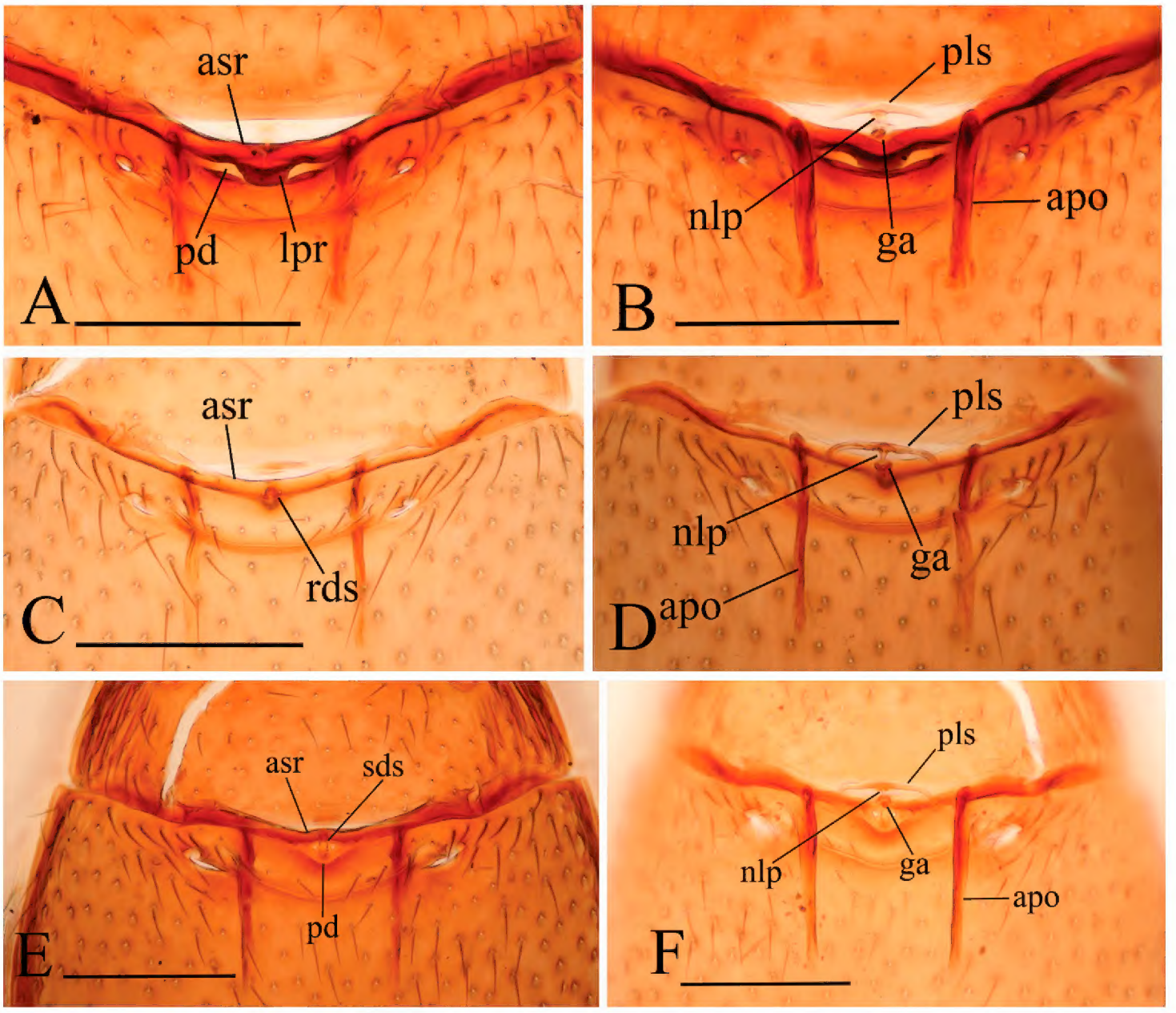

Figure 23. Female copulatory organ. **A, B** *Opopaea berlandi* **C, D** *Opopaea kulczynskii* **E, F** *Opopaea sheldrick* sp. nov. **A, C, E** ventral view **B, D, F** dorsal view. Abbreviations: apo = apodeme; asr = anterior scutal ridge; ga = globular appendix; lpr = linguiform projection; nlp = nail-like process; pd = postgynal depression; pls = paddle-like sclerite; rds = ring-shaped dark spot; sds = stick-shaped dark spot. Scale bars: 0.2 mm.

tudinal streaks; dorsal area smooth, with some hairs at lateral edges. Eyes: ALE largest, PLE and AME nearly equal sized; posterior eye row recurved viewed from above, procurved from front; ALE separated by their radius, ALE-PLE separated by less than ALE radius, PME touching throughout most of their length, PLE-PME separated by less than PME radius. Clypeus height about equal to ALE diameter (Fig. 18G). Sternum (Fig. 18F) longer than wide, fused to carapace; surface smooth; radial furrows present. Anterior end of endites with a small, sharply pointed projection. Legs brown, short, thick and spineless. Abdomen: booklung covers very small, ovoid, without setae. Pedicel tube short, ribbed, with small, dorsolateral, triangular extensions, scuto-pedicel region lower than diameter of pedicel, with arched scutal ridges and curved anterior scutal ridge (Fig. 18H). Palp (Figs 19, 22G–I): reddish brown; palpal femur about half the length of patella and inserted at the patella submedially; patella large; cymbiobulbus shorter than the patella; palpal fenestra large and located at nearly the tip of the palp. Tip of the palp very narrow.

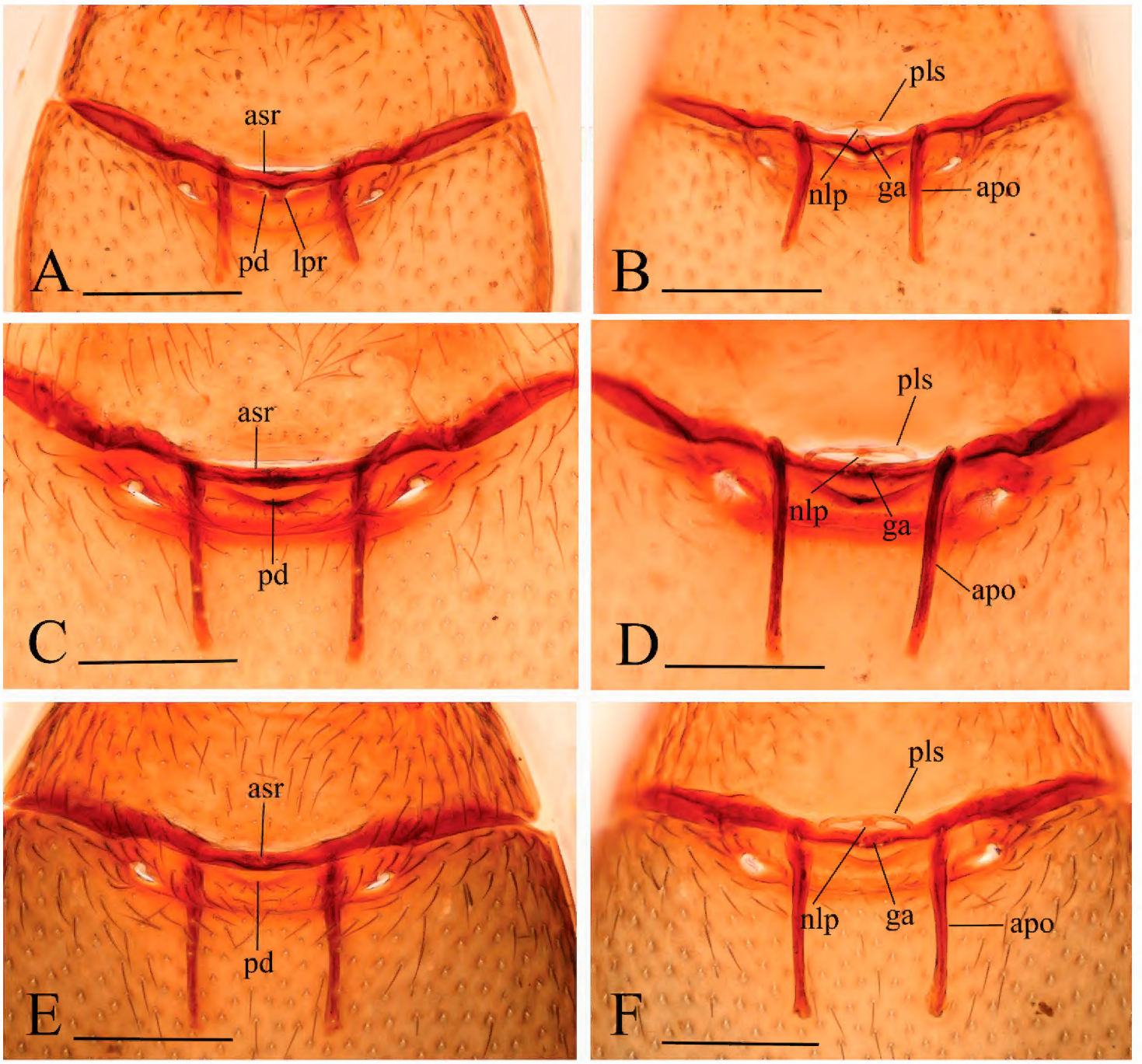

Figure 24. Female copulatory organ. **A, B** *Opopaea makadara* sp. nov. **C, D** *Opopaea ngangao* sp. nov. **E, F** *Opopaea wundanyi* sp. nov. **A, C, E** ventral view **B, D, F** dorsal view. Abbreviations: apo = apodeme; asr = anterior scutal ridge; ga = globular appendix; lpr = linguiform projection; nlp = nail-like process; pd = postgynal depression; pls = paddle-like sclerite. Scale bars: 0.2 mm.

Female. As in male except as noted. Habitus as in Fig. 20A, C, E. Body length 2.19. Endites without projections. Copulatory organ (Figs 20H, 24E, F): postgynal depression narrow, about one third the length between epigastric furrow and the shallow groove connecting tracheal spiracles; there a paddle-like sclerite (pls) dorsally, with thin, fork-shaped arms; nail-like process (nlp) well separated.

Measurements. Male (holotype). TL: 1.90; CL: 0.80; CW: 0.65; AL: 1.08; AW: 0.75; ALE: 0.08; PME: 0.06; PLE: 0.06; EGW: 0.23; ALE-ALE: 0.04; ALE-PLE: 0.01; PME-PME: 0; PLE-PME: 0; CBL: 0.27; CBW: 0.09; PTL: 0.30; FI: 0.13; FML: 0.16.

Female. TL: 2.13; CL: 0.85; CW: 0.67; AL: 1.30; AW: 0.82; ALE: 0.08; PME: 0.06; PLE: 0.06; EGW: 0.23; ALE-ALE: 0.04; ALE-PLE: 0.01; PME-PME: 0; PLE-PME: 0.

Distribution. Known only from the type locality.

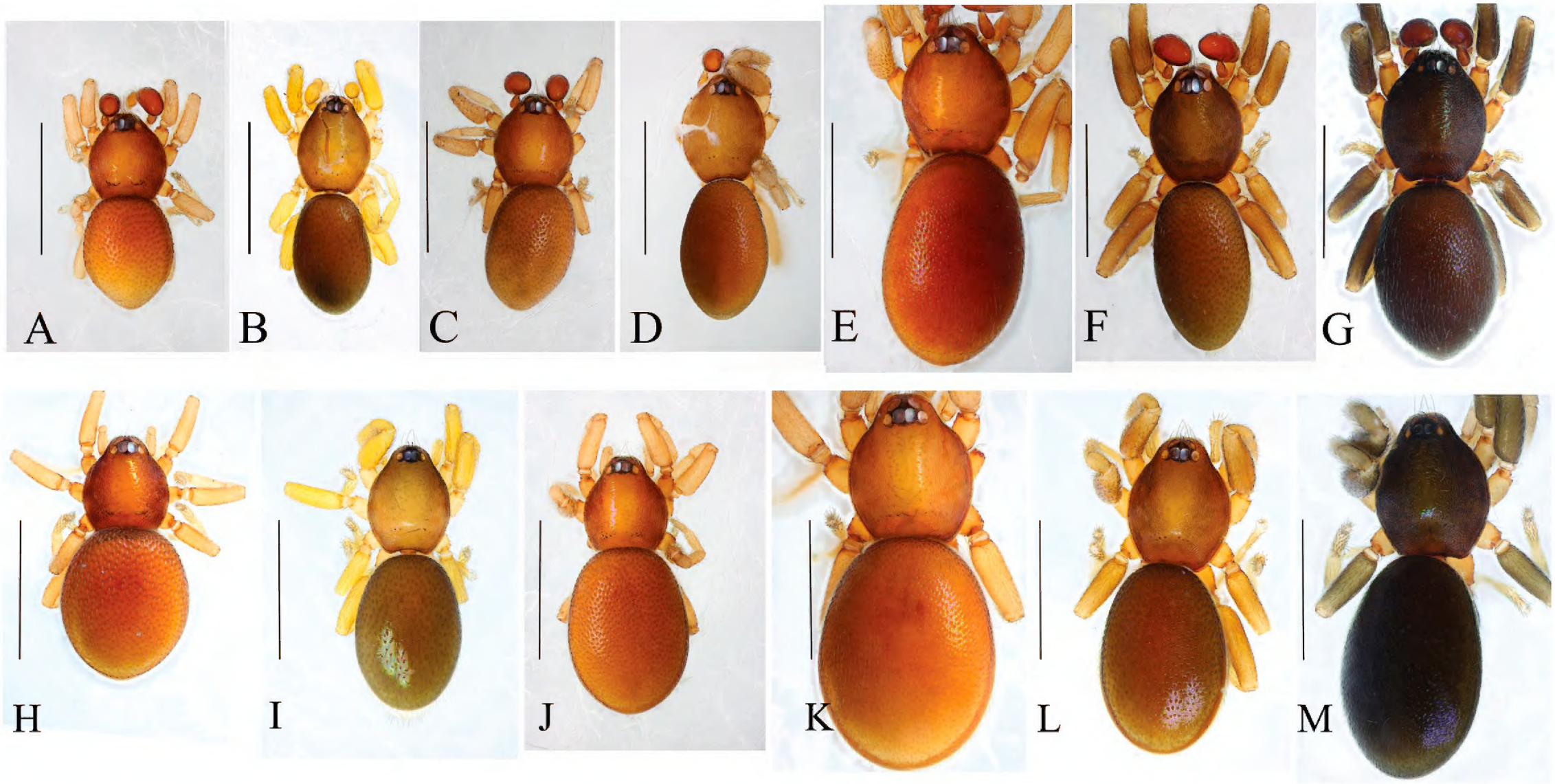

Figure 25. Habitus of males (**A–G**) and females (**H–M**). **A, H** *Opopaea berlandi* **B, I** *Opopaea kulczynskii* **C, J** *Opopaea makadara* sp. nov. **D** *Opopaea ngulia* sp. nov. **E, K** *Opopaea ngangao* sp. nov. **F, L** *Opopaea sheldrick* sp. nov. **G, M** *Opopaea wundanyi* sp. nov. Scale bars: 0.8 mm.

Acknowledgments

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